AD-A167 750 QUALITY ASSURANCE OF THE MODIFIED CLASS CC MOORING INSTALLATION AT GUAM(U) NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON DC CHESAPEAKE DIV T J O'BOYLE 1/1

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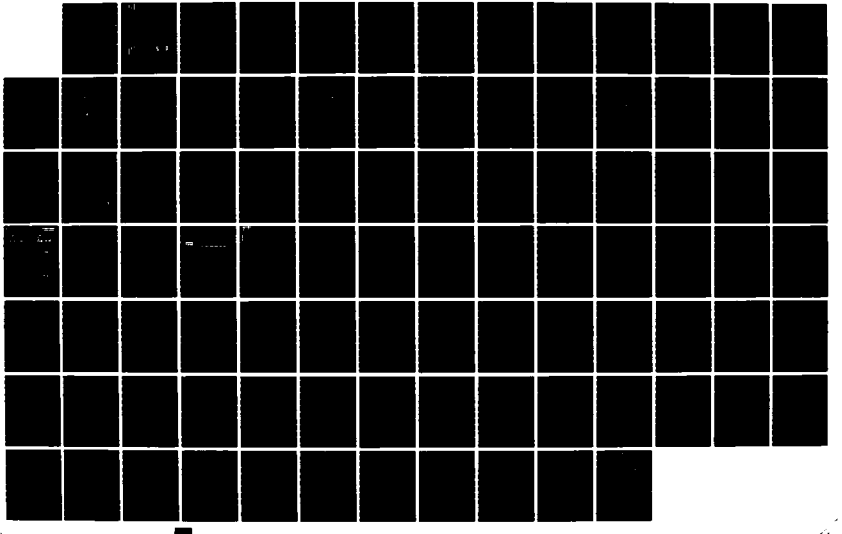

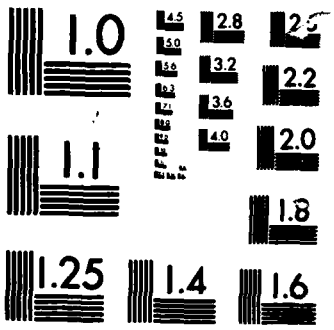

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QUALITY ASSURANCE OF THE MODIFIED CLASS CC MOORING INSTALLATION AT GUAM

BY
T. J. O'BOYLE

NOVEMBER 1980

OCEAN ENGINEERING
AND CONSTRUCTION PROJECT OFFICE
CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON,D.C. 20374

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SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION
Unclassified

1b. RESTRICTIVE MARKINGS

2a. SECURITY CLASSIFICATION AUTHORITY

3. DISTRIBUTION AVAILABILITY OF REP.
Approved for public release; distribution is unlimited

2b. DECLASSIFICATION/DOWNGRADING SCHEDULE

4. PERFORMING ORGANIZATION REPORT NUMBER
FPO 8021

5. MONITORING ORGANIZATION REPORT #

6a. NAME OF PERFORM. ORG. 6b. OFFICE SYM
Ocean Engineering
& Construction
Project Office
CHESNAVFACENGCOM

7a. NAME OF MONITORING ORGANIZATION

6c. ADDRESS (City, State, and Zip Code)
Bldg. 212, Washington Navy Yard
Washington, D.C. 20374-2121

7b. ADDRESS (City, State, and Zip)

8a. NAME OF FUNDING ORG. 8b. OFFICE SYM

9. PROCUREMENT INSTRUMENT INDENT #

8c. ADDRESS (City, State & Zip)

10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT #	PROJECT #	TASK #	WORK UNIT ACCESS #

11. TITLE (Including Security Classification)
Quality Assurance of the Modified Class CC Mooring Installation at Guam

12. PERSONAL AUTHOR(S)
T.J. O'Boyle

13a. TYPE OF REPORT 13b. TIME COVERED FROM TO 14. DATE OF REP. (YYMMDD) 80-11 15. PAGES 89

16. SUPPLEMENTARY NOTATION

17. COSATI CODES

FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (Continue on reverse if nec.
Mooring installations, Guam

19. ABSTRACT (Continue on reverse if necessary & identify by block number)
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20. DISTRIBUTION/AVAILABILITY OF ABSTRACT
SAME AS RPT.

21. ABSTRACT SECURITY CLASSIFICATION

22a. NAME OF RESPONSIBLE INDIVIDUAL
Jacqueline B. Riley

22b. TELEPHONE
202-433-3881

22c. OFFICE SYMBOL

DD FORM 1473, 84MAR

SECURITY CLASSIFICATION OF THIS PAGE

BLOCK 19 (Con't)

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QUALITY ASSURANCE
OF
MODIFIED CLASS CC MOORING
INSTALLATION AT GUAM

NOVEMBER 1980

By T. J. O'BOYLE

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1-29-81

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1/30/81

OCEAN ENGINEERING AND CONSTRUCTION PROJECT OFFICE
CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON, D.C. 20374

FPO-1ED7:eew
26 Jan 1981

MEMORANDUM

From: FPO-1ED7
To: Modified Class CC Mooring Project File

Subj: QA of Installation

Ref: (a) COMNAVELEXSYSCOM ltr PME-124-612:LL, Ser 639C of 24 Sep 79
(b) CHESNAVFACENGCOM 041734Z Dec 79
(c) CHESNAVFACENGCOM 161615Z Jan 80
(d) CHESNAVFACENGCOM ltr FPO-1E:bw, Ser 11000 of 17 Jan 80
(e) CHESNAVFACENGCOM ltr FPO-1E6:bw, Ser 11000 of 28 Feb 80
(f) CHESNAVFACENGCOM ltr FPO-1E6:bw, Ser 11000 of 12 Mar 80
(g) COMNAVELEXSYSCOM 242149Z Oct 80
(h) CHESNAVFACENGCOM 071604Z Nov 80

Encl: (1) Copy of Ref (a)
(2) Copy of Ref (b)
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(4) Copy of Ref (d)
(5) Copy of Ref (e)
(6) Copy of Ref (f)
(7) Copy of Ref (g)
(8) Copy of Ref (h)

1. On 24 Sep 1979, CHESDIV (FPO-1), received a tasking letter to design a Modified Class CC Mooring (ref (a); encl (1)). FPO-1 accepted this task on 22 Oct 1979, and on 4 Dec 1979 issued a revised set of milestones for the subject project (ref (b); encl (2)). A message containing the firm hardware list (ref (c); encl (3)) was sent to PACDIV and PWC Guam on 16 Jan 1980 and was followed with a letter containing supplementary information in support of procurement and installation (ref (d); encl (4)) on 17 Jan 1980. The sinker design was forwarded to PACDIV on 28 Feb 1980 (ref (e); encl (5)) and the installation guidelines for the subject mooring were sent to PACDIV on 12 Mar 1980, (ref (f); encl (6)). The installation guidelines called for a 100 kip pull on each chain but, as stated in ref (g); encl (7) , the funds for anchor setting and pull tests were not available. Because of this restricted funding, FPO-1 reviewed the anchor setting and pull test requirements and on 7 Nov 1980 sent PACDIV and PWC Guam a list of the minimum quality assurance (QA) requirements that had to be met (ref (h); encl (8)). To ensure that the QA requirements actaully were met, CHESDIV (FPO-1) sent Mr. Tom O'Boyle to Guam as their on-site representative during the installation.

2. The mooring location is approximately 500 feet west of the existing 25N/25S mooring. (See Figure 1.) The mooring configuration is a three-legged array with two ground chains per leg as in a DM-26 class CC mooring. (See Figures 2 & 3.) Each ground chain terminates in a pair of tandem anchors. At the other end of the six chain legs, the termination is at a common ground ring. A single 15,000 pound (in water weight) sinker is attached directly to the ground ring, and a 3.5 inch riser chain connects the ground ring to a 12 foot diameter buoy. The designed hawser from the buoy to the ship is a dual parallel 4.25 inch diameter ~~(13 inch circumference)~~ Samson 2 in 1 nylon hawser. However, these hawsers are not available and the substitute ~~is a dual~~ parallel 5 inch diameter (15 inch circumference), Samson 2 in 1 nylon hawser.

3. To install and maintain the moorings in Apra Harbor, PWC Guam uses a YFNB barge as a work platform. The barge's deck house has been cut off to provide a 140 feet ~~(approximately)~~ clear work deck from the stern, forward. To accomplish their work on the moorings, PWC secured a 60 ton, crawler crane to the deck, left of the centerline and at the stern. To the right of the centerline, at the forward end of the work area, PWC secured a 3 drum 10 kip winch. Each of the drums wire ropes passes through its own 5-part block system. The crane and the 3 drum winch are the only pieces of machinery used by PWC to do mooring work.

4. The installation procedure, summarized in ref (h), called for using the 60 ton crane and the 10K winch. Because the crane was inoperative, the installation procedure was changed to use the 10K winch only and the retrievable lowering cable was replaced with 45 foot lengths of old 2½" stud-link chain. This "Emplacement" chain was secured to each anchor's crown pin (see Figure 4) and remained attached to the crown pin after the anchor was deployed. The emplacement chain had three uses: (1) the chain was held by pelican hooks on the deck to secure the anchors, after the anchors were rigged over the stern; (2) the anchors were lowered using the chain; (3) the end of the emplacement chain was secured to the barge's deck, using a pelican hook, when a strain was to be applied to the 2½" ground chain.

5. A section of each 2½" ground chain was to be connected to the ground ring above the sinker prior to lowering the sinker into the water. This would avoid the necessity of picking up the ground ring to make any chain connection or to use divers to connect the chain to the ground ring. The six sections of 2½" chain were divided into 3 pairs and each pair connected

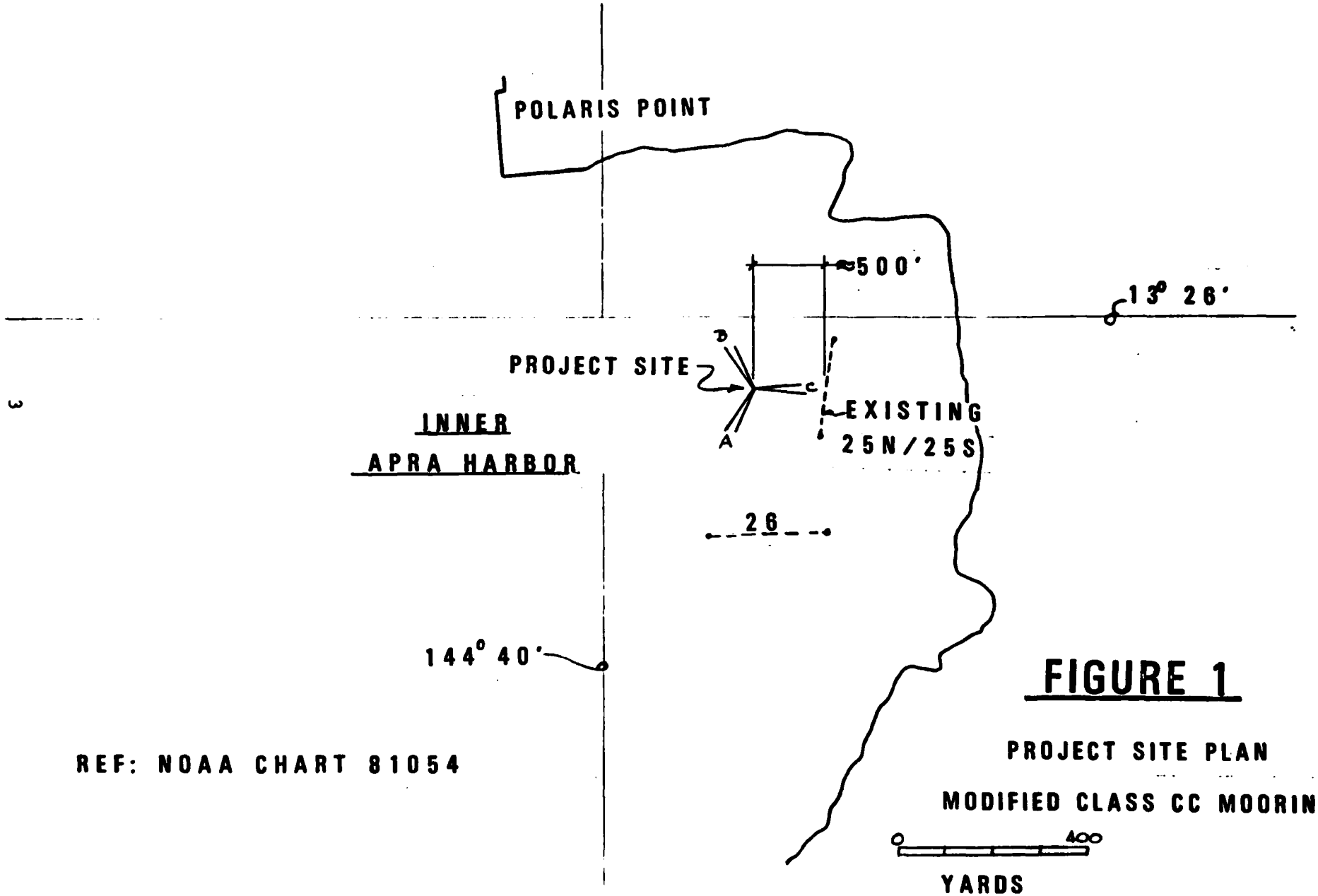

POLARIS POINT
500'
13° 26'
D
PROJECT SITE
C
A
EXISTING
25N/25S
INNER
APRA HARBOR
26
144° 40'
REF: NOAA CHART 81054
PROJECT SITE PLAN
MODIFIED CLASS CC MOORING
0
400
YARDS

FIGURE 1

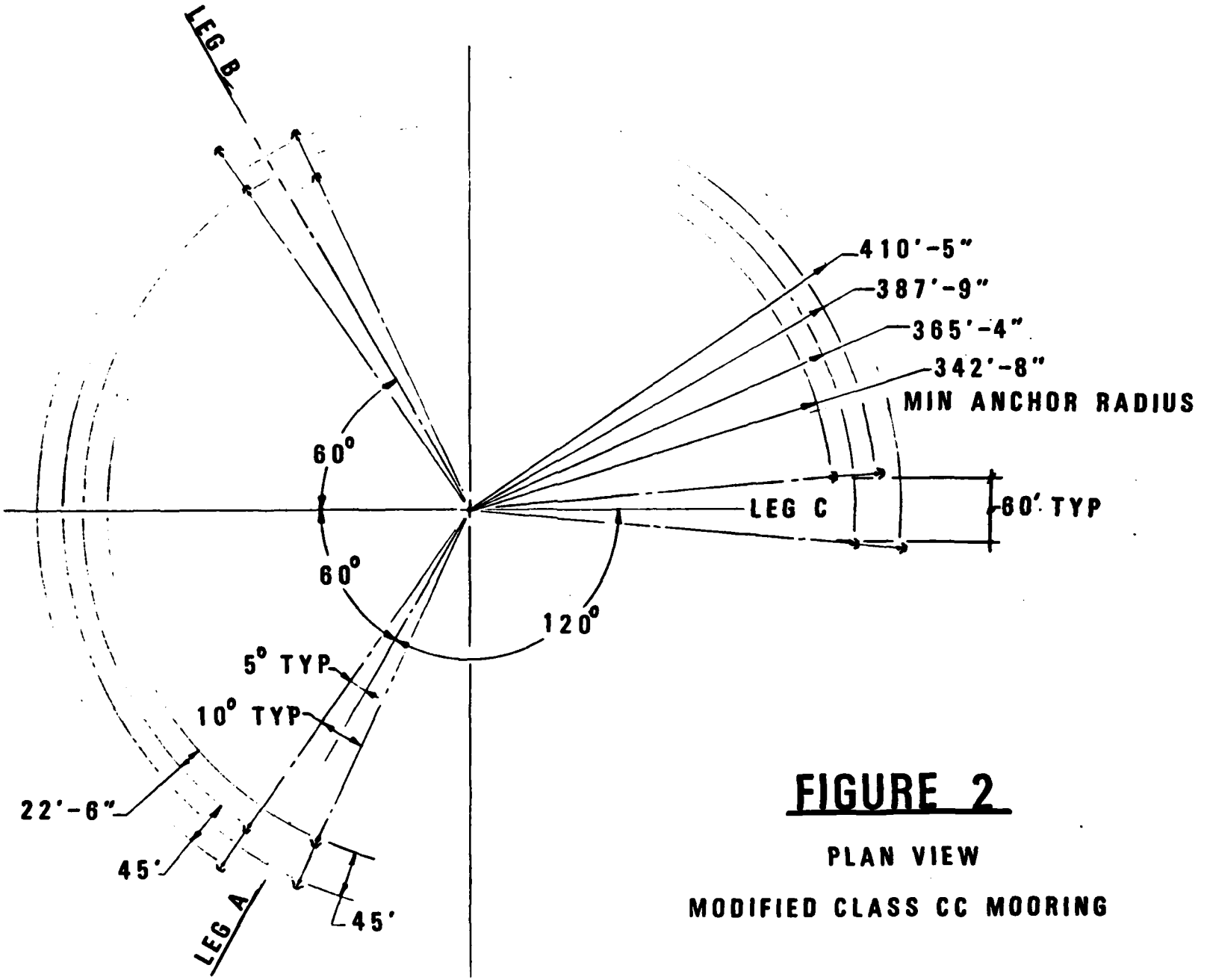


FIGURE 2

PLAN VIEW

MODIFIED CLASS CC MOORING

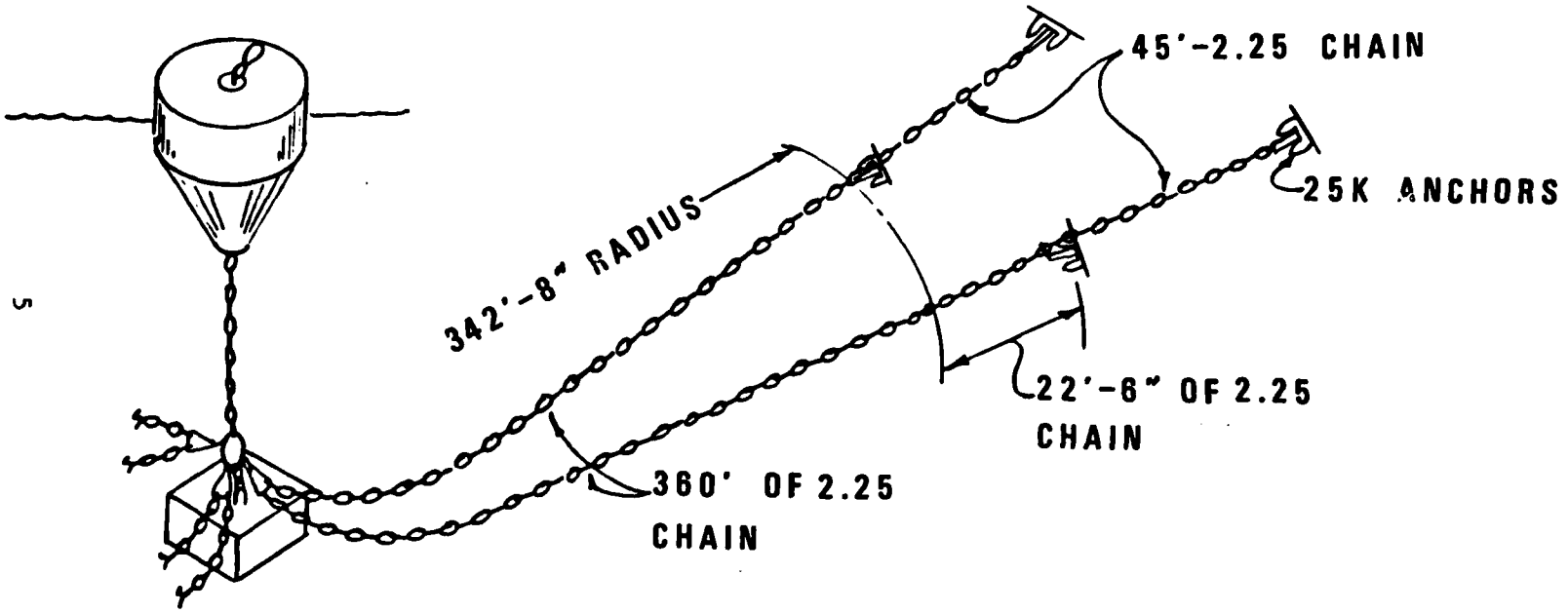


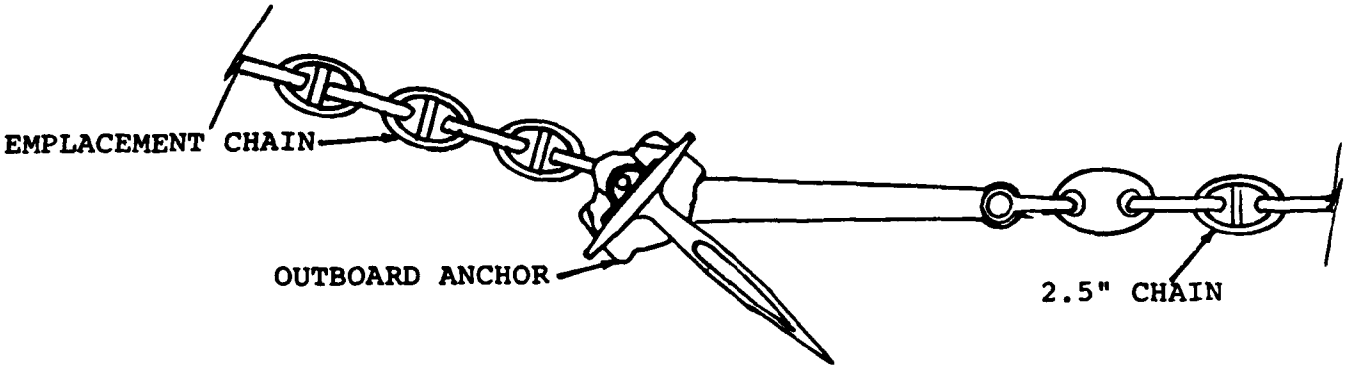
FIGURE 3

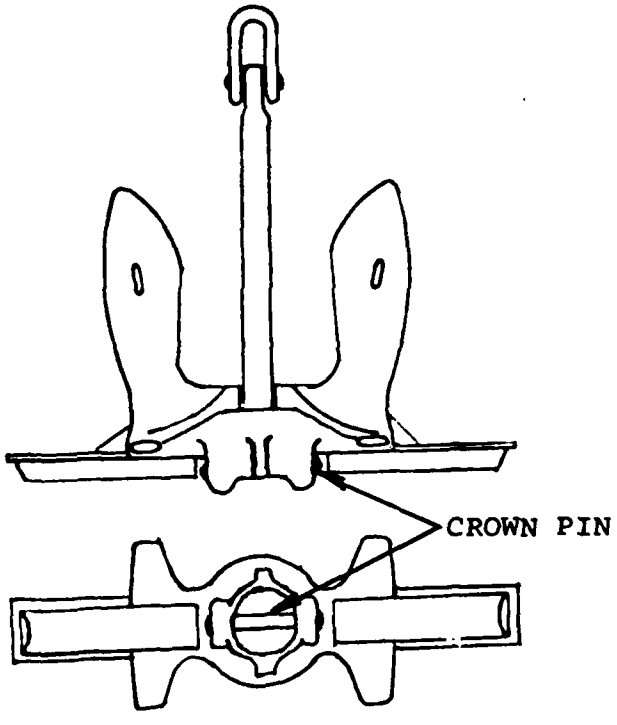
PICTORAL VIEW

MODIFIED CLASS CC MOORINGS

FIGURE 4

ATTACHMENT OF EMPLACEMENT CHAIN TO CROWN PIN





to the ground ring using a spider plate. To ensure that the sinker would rest on the bottom, and that the section of 2½" chain, connected to the spider plate at one end, was long enough to permit the hauling of the other end up on the barge without lifting the sinker, each 2½" chain section was one shot (90') long. PWC rigged the 6 pick up chain sections for the 3 chain pairs, so the long and short chain of each pair would be together on their own buoy. (See Figure 5.) Each chain was color coded red or yellow for the long or short chain respectively. This was done so the correct side of the spider plate would go to the correct set of anchor marker buoys, and there would be no crossing of the chains.

6. For this installation scenario, using only the 10K winch, the anchors were to be rigged over the barge's stern. (See Figure 6.) Then, after the connection of the 2½" ground chain to the proper pick up chain, the ground chain would be let out using the winch as the barge moved toward the anchor marker buoys. The end of the inboard anchor's emplacement chain would be secured with a pelican hook on the deck and a strain put on the ground chain to straighten it. After the release of the inboard anchor, the winch would be used to let out the outboard anchors emplacement chain so its' end could be placed in a deck mounted pelican hook. The chain between the anchors would be straightened by applying a strain to the outboard anchor. Having the emplacement chain connected to the crown pin and installing the anchors as discussed, would satisfy the QA requirement that the flukes be in the correct orientation.

7. On Monday, 17 Nov 1980, the main buoy, the 3 pick-up buoys, the riser chain, sinker, and 6 shots of pick-up chain were rigged and hoisted simultaneously using the 100 ton (YD-226) crane. Everything was then lowered into the water at the center marker buoy. The rest of the day was spent rigging the first long 2½" chain on the PWC barge. For this first chain, both outboard and inboard anchors were placed on the deck and the ground chain secured to both of them. The emplacement chain was then secured to the crown pin of each anchor. Both anchors were then picked up at the same time using both hooks of the YD crane. The PWC riggers had some problems manuvering the two anchors into the correct orientation so they could be secured over the stern, but the problems were solved and the rigging of this first chain on the PWC barge was completed.

8. The first thing Tuesday morning, 18 Nov 1980, the PWC barge got under way to install the first chain. Two tugs tied to the barge, such that they would back away from the main buoy. After the connection of the 2½" chain to the pick up shot was made, the tug started to back down and the ground chain was slacked out using the winch. As the chain was being slacked out, an air fitting on the winch controls broke, and the winch was unable to pay out its' wire. The PWC riggers found the problem

FIGURE 5

BUOYS USED TO HOLD PICK UP CHAINS

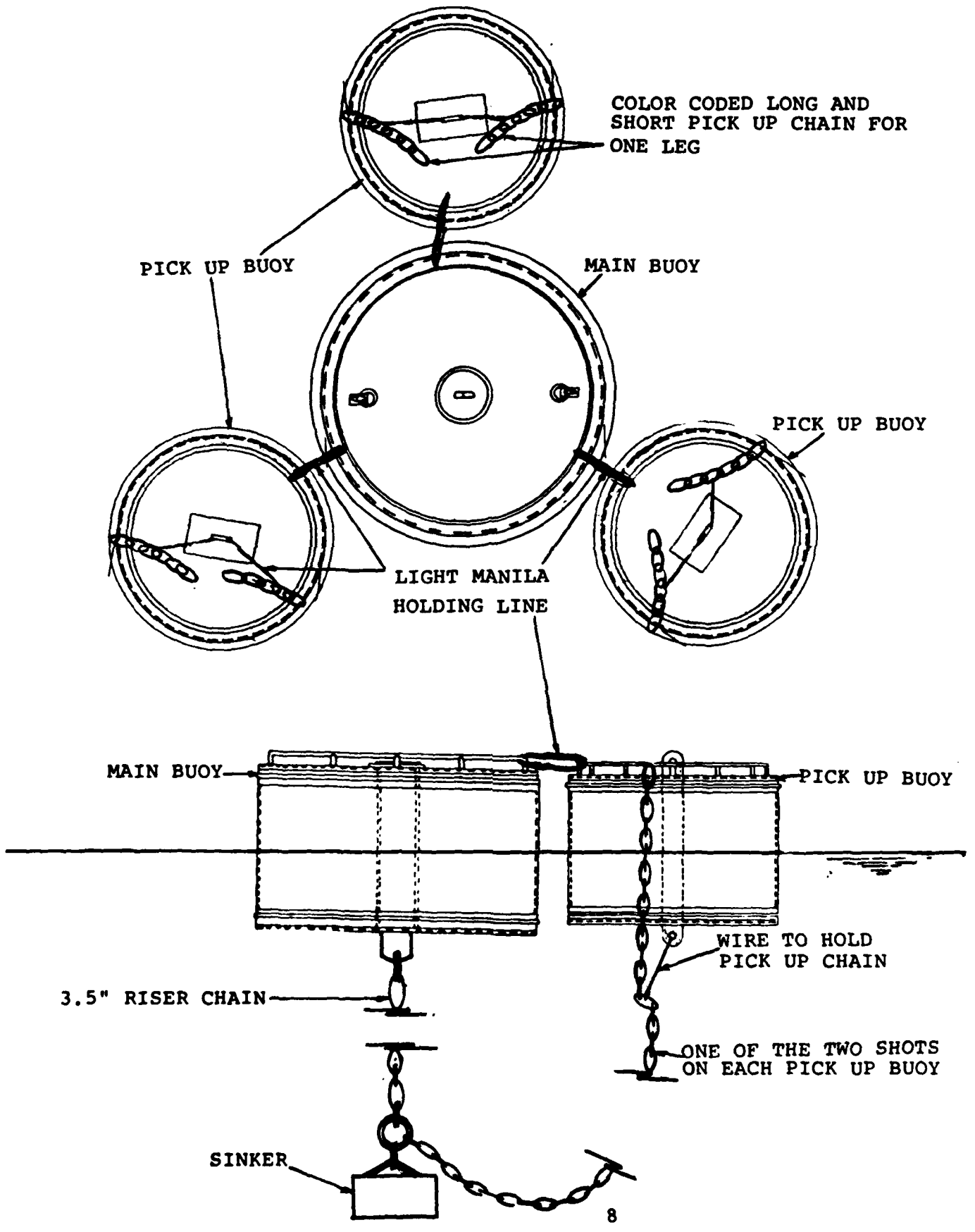
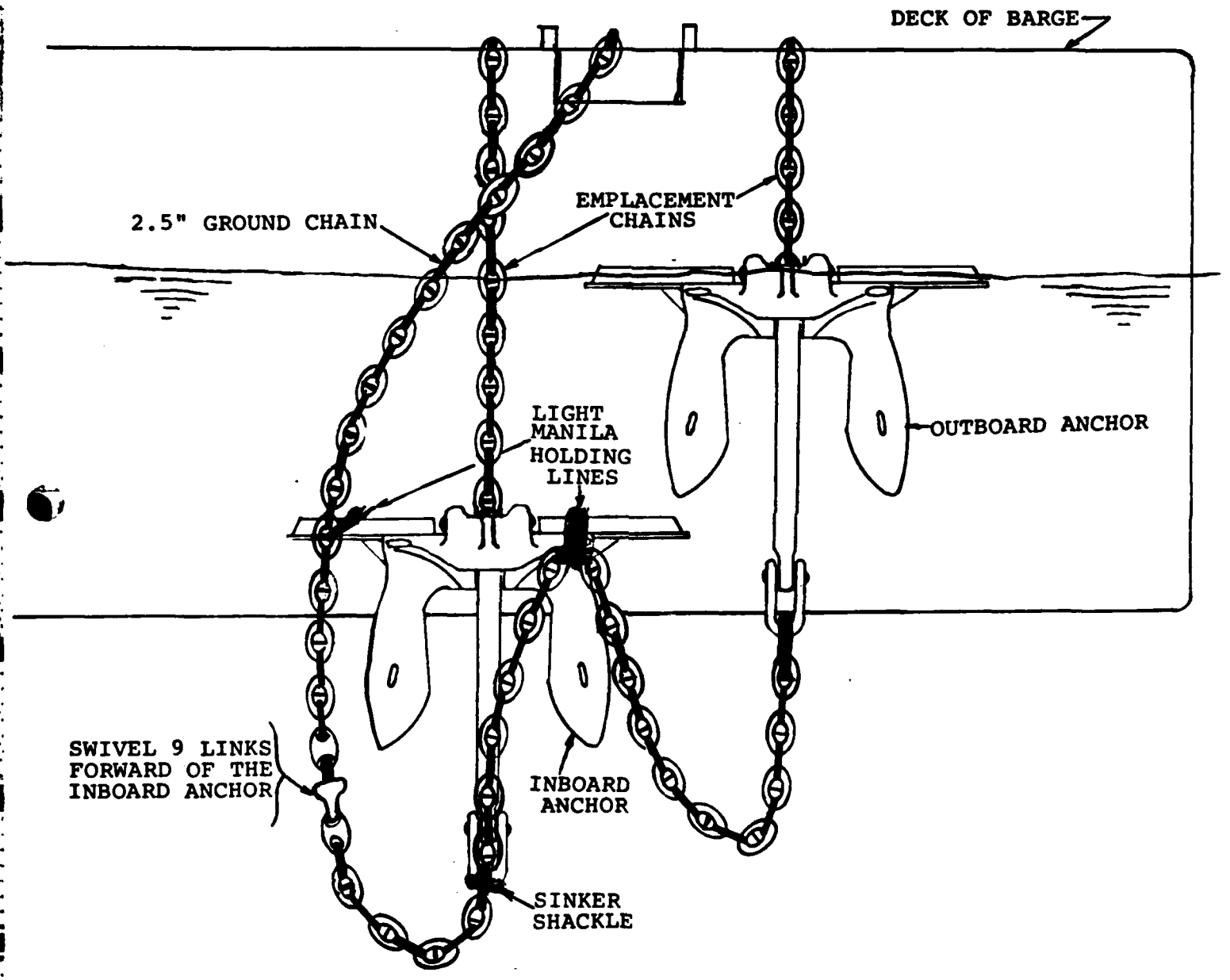


FIGURE 6

RIGGING OF ANCHORS OVER BARGE STERN



and made the repair. With the winch repaired, the rest of the first chain was laid on the bottom. The strain that was put on the inboard anchor pulled the buoy off center approximately 40 feet. (See Figure 7.) After the first chain and anchors were deployed, the barge returned to the wharf and the second chain was rigged out, one anchor at a time. First the inboard anchor was rigged and secured over the stern, followed by the outboard anchor. In the late afternoon of the same day, the barge was towed out and this second chain was installed. As the installation was nearing an end, it looked like the 2½" chain was wrapped around the inboard anchor and fouled. The installation process had too much momentum to stop, and the outboard anchor was let go and the chain was implanted on the bottom with no pick up wire.

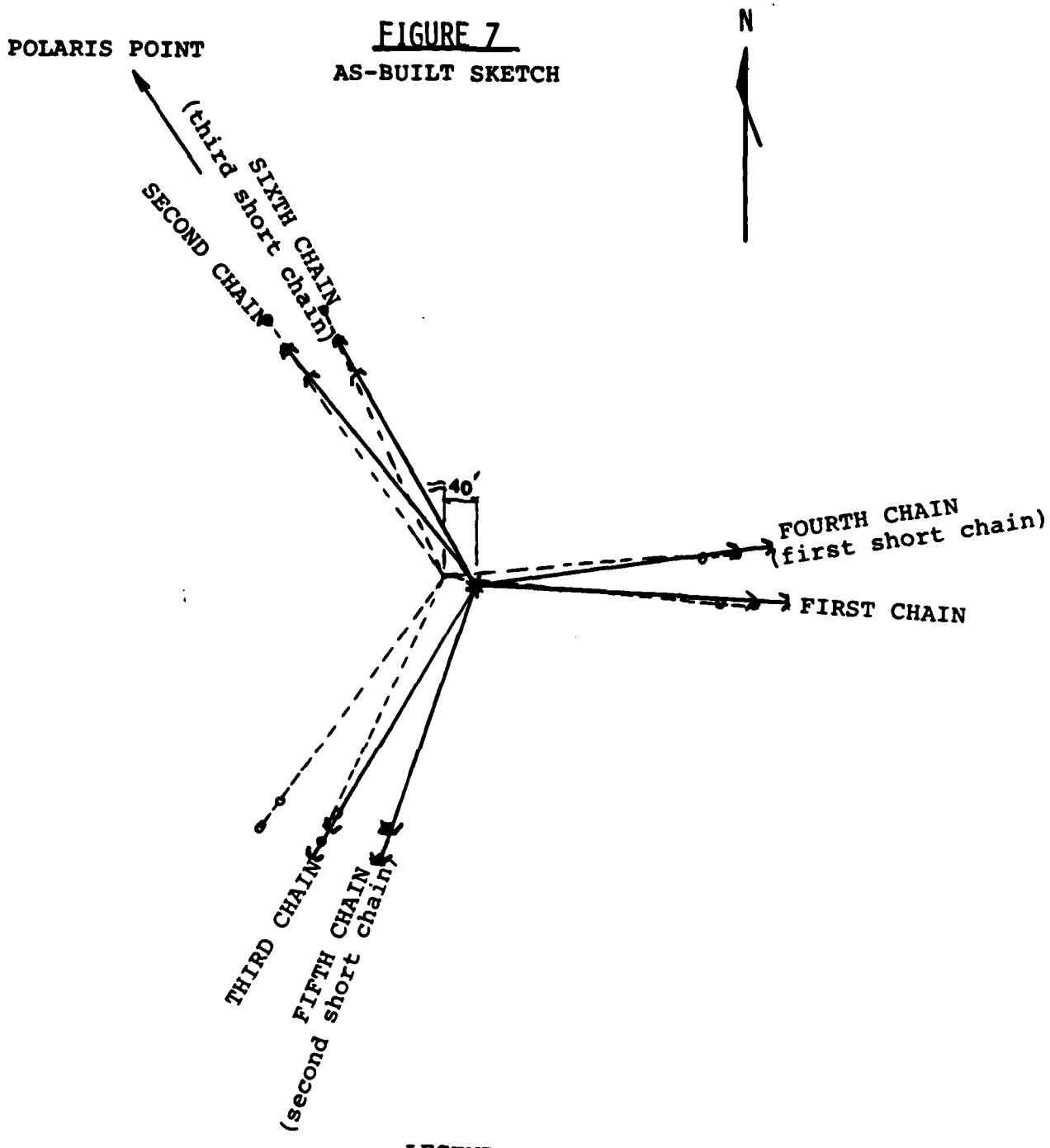
9. At this time, answers to the following questions were needed: (a) was the riser tight or slack on the bottom? (b) could a diver see the inboard anchor's crown to tell if it was fouled? To get these answers, the base divelocker was asked on Wednesday (19 Nov 1980) to provide the needed divers to go down and look for the sinker and anchor and determine straightness of the chains. The divers were instructed to photograph anything they could see. The divers reported that the sinker must be under the mud as the riser was tight and went straight down into the mud and they could not see any part of the sinker. The divers also said that they could not see any 2½" chain or anchors, and that visibility from 4' above the bottom was 0. This lack of visibility indicated that the bottom was indeed very soft on top.

10. While the dive was in progress, the third chain was being rigged on the PWC barge. After the divers moved off, barge preparations were made to install this chain. It was planned to back down full with both tugs and pull the sinker/buoy back to the middle. The pilot was to use the momentum of the tugs and barge to try to pull the sinker loose. Two things were wrong with this procedure: (a) the barge was pulling directly against the first chain and could not move the sinker; (b) the chain was only secured with a pelican hook attached to a 5-part block and not to a padeye. During the surging motion the holding pin in the 5-part block was overstressed and broke.

11. Pulling the buoy back to its' intended location was abandoned, and the barge was lined up to install the third chain. The tugs backed away from the main buoy and the inboard anchor was lowered to the bottom. As shown in Figure 7, this anchor was installed on the wrong set of anchor marker buoys. If the second chain of this pair were to be laid using the other marker buoy, the chains would cross at the spider plate. This crossing would violate the quality assurance requirement that the chains be straight and tight. To avoid this, the anchor marker buoys for the short chain were resurveyed in on the east side of the present third chain's position

FIGURE 7

AS-BUILT SKETCH



LEGEND

o o	DESIGN ANCHOR MARKER BUOYS
- - - -	DESIGN POSITION OF CHAIN
Δ Δ	RESURVEYED ANCHOR MARKER BUOYS
*	APPROXIMATE ACTUAL BUOY POSITION
⊢ ⊢	APPROXIMATE ACTUAL ANCHOR POSITION
———	APPROXIMATE ACTUAL POSITION OF CHAIN

and this third chain was left as installed. (See Figure 7.) With the main buoy moved off center by the first chain, relocating the markers, as shown in Figure 7, appeared to bring the angle between legs back closer to 120 degrees.

12. The first of the shorter chains was rigged on the PWC barge during the morning of Thursday, 20 Dec. As the rigging progressed, it was noticed that the sinker shackle holding the inboard anchor to the ground chain was attached incorrectly. (See Figure 8a.) Using the method of attachment shown would cause the chain to become kinked at the sinker shackle during deployment, resulting in inboard anchor rotation. (The rigging procedure used on the first chain and the observed orientation of the inboard anchor while under tension during the installation of the second and third chains, indicated that, the sinker shackle was connected correctly on these chains.) The riggers remade the connection, the correct way, as shown in Figure 8b. The design length of this first short chain was 387 feet, but actually measured 396 feet. To avoid the possibility of anchor interference, the chain was cut to match the design length. This first short chain was put in that afternoon with no problems.

13. On Friday morning, three tasks progressed concurrently: (1) the second short chain was rigged on the PWC barge; (2) the surveyers went out to resurvey and install the anchor marker buoys on the east side of the third chain and also a new center marker; (3) a meeting was held with Ed San Nicolas to discuss picking up the second chain. The rigging of the second short chain progressed normally, with extra emphasis placed on the correct sinker shackle attachment to the inboard anchor. At the meeting, CHESDIV expressed concern that the inboard anchor on the second chain might be fouled. That morning, it was agreed to sweep for the second chain after installing the already rigged second short chain on the anchor markers the surveyers had just implanted. (See Figure 7.) A 9 kip stockless anchor was to be used for grappling, being pulled with a 2½" chain that was to be used as the last short chain on the buoy installation.

14. On Friday afternoon the PWC barge was towed out and the second short chain was laid using the newly surveyed anchor marker buoys. The barge returned to the wharf and the 9 kip grappling anchor was rigged. While the rigging was in progress, a 34 foot length of ½" chain was painted with a yellow marker every foot and a red marker every 5 feet. This chain was to be used in measuring the height of the buoy during the lift operation planned for Monday. After the rigging was completed, the barge was towed to the second chain's position and the 9-kip grappling anchor deployed. Three futile attempts were made to snag the 2½ inch chain in question. It was felt that the 9 kip grappling anchor was not going deep enough to reach the chain between the two anchors. At this time the Naval Station went to Tropical Storm condition 3 and the tugs had to abandon their participation in the operation for other duties.

FIGURE 8A

SKETCH OF WRONG SINKER SHACKLE CONNECTION

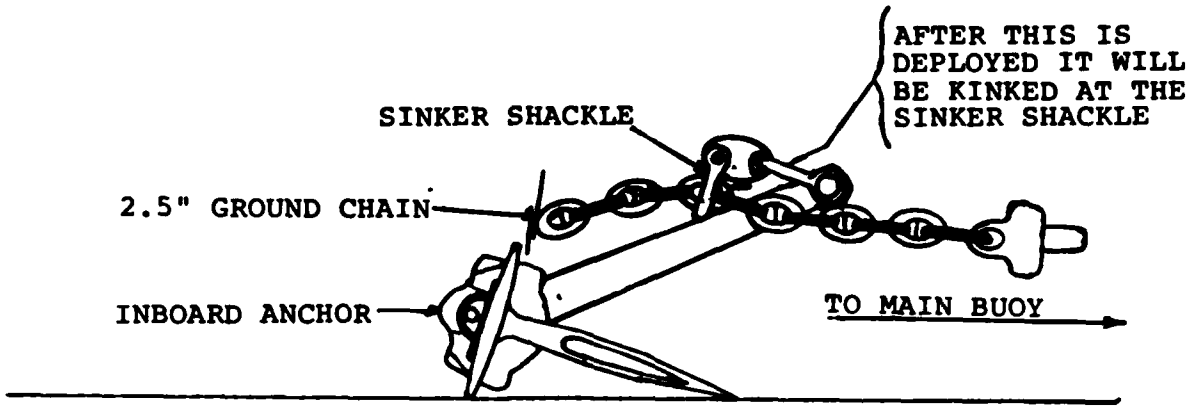
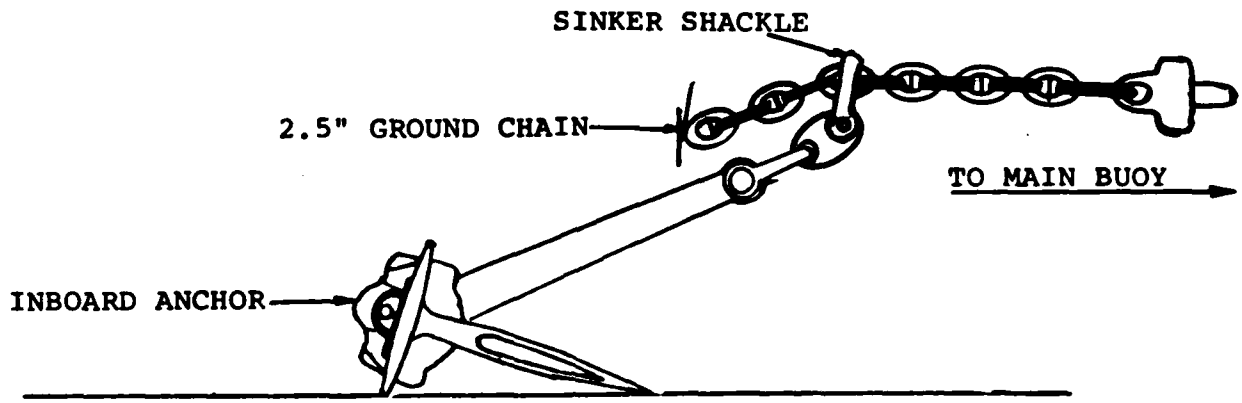


FIGURE 8B

SKETCH OF CORRECT SINKER SHACKLE CONNECTION



15. The tropical storm went north, missing Guam completely. Because the harbor was secured for a possible typhoon, it was not until late in the morning on Monday, 24 Nov. that the PWC barge was returned to the wharf. At that time, a 13 kip grappling anchor was rigged to sweep closer to the buoy for the 2½" chain in question. As one of the tugs was down for the day, the only boats available were one tug and two pushers. Using these boats, the sweeping procedure was tried three more times, but again PWC could not snag the 2½" chain. It was decided to leave the 2½" chain in question as installed because: (a) the relative location where the inboard and outboard anchors were installed, indicated that in all probability, the entire length of chain was used and tight; (b) the only way to retrieve the chain would be to lift up the buoy high enough to detach the chain in question, but this procedure would destroy the mooring. The barge returned to the wharf and the PWC riggers started to rig out the last chain. Night was setting in fast and the attachment of the sinker shackle to the inboard anchor was the last thing accomplished that day.

16. On Tuesday morning, while the remainder of the last chain was being rigged on the PWC barge, the lift procedure, and the results expected from it, were discussed with the transportation department. CHESDIV explained that the results of numerous calculations had been plotted to show the force needed to pick up the buoy to various heights depending on how far the anchors moved in from a completely tight condition. (See Figure 9a.) Knowing how high the buoy was picked up and the approximate distance the anchors moved in, Figure 9b could then be used to find the force that was felt by each anchor. These two graphs (Figures 9a & 9b) would be used by CHESDIV to give an idea of how tight the mooring was. At the conclusion of the meeting, the PWC barge departed to install the last chain.

17. Because the barge had been maneuvered around by the harbor pilot to line up with the marker buoys, the chain was not straight. To make certain the chain was straight, both tugs were going to pull back full while the inboard anchor was secured to the barge. During this pull, the inboard anchor became detached from the 2½" chain. The YD was then called over to pick up the anchors and chain to see what had happened. It was discovered that the anchor joining link (see Figure 10) was not on the anchor and also not connected to the sinker shackle that was still on the chain. There were no parts of the anchor joining link left to tell what had happened, and no attempt was made to try and recover the pieces from the soft bottom. The anchor joining link and sinker shackle were replaced and the anchors were again rigged to install. The last chain was installed late that afternoon. The YD, used to retrieve the anchors, was kept on site and now moved into position to perform the buoy lift. At this time the tugs departed to do other work. It was then ascertained there were no shackles on the 100 ton YD, with a rating above 35 tons, that could be

FIGURE 9A

LIFT HEIGHT vs TOTAL VERTICAL FORCE

(CALCULATED USING THE CATENARY EQUATIONS)

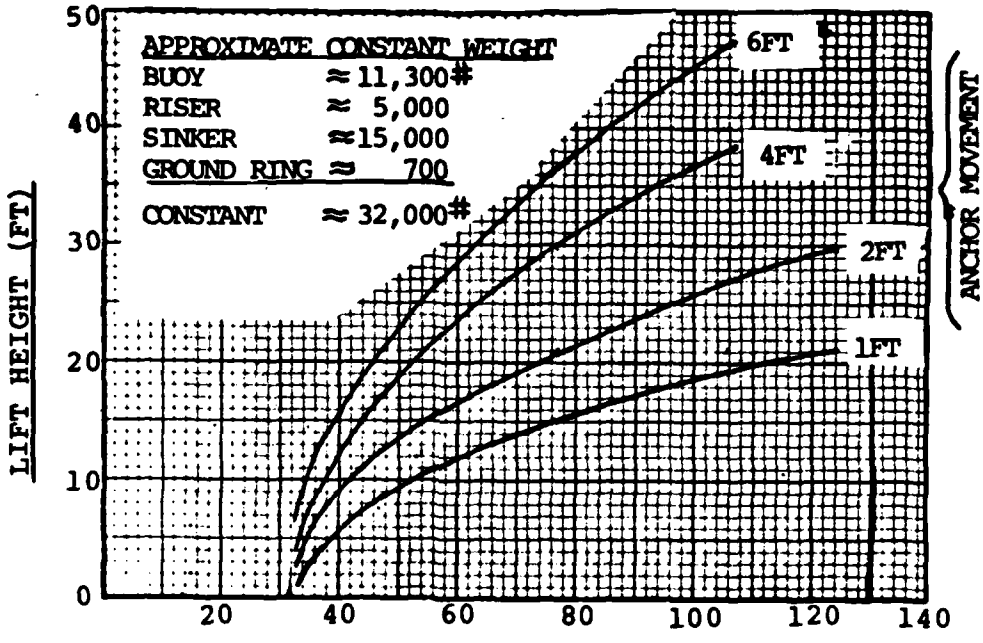


FIGURE 9B

LIFT HEIGHT vs HORZONTAL FORCE IN GROUND RING

(CALCULATED USING THE CATENARY EQUATIONS)

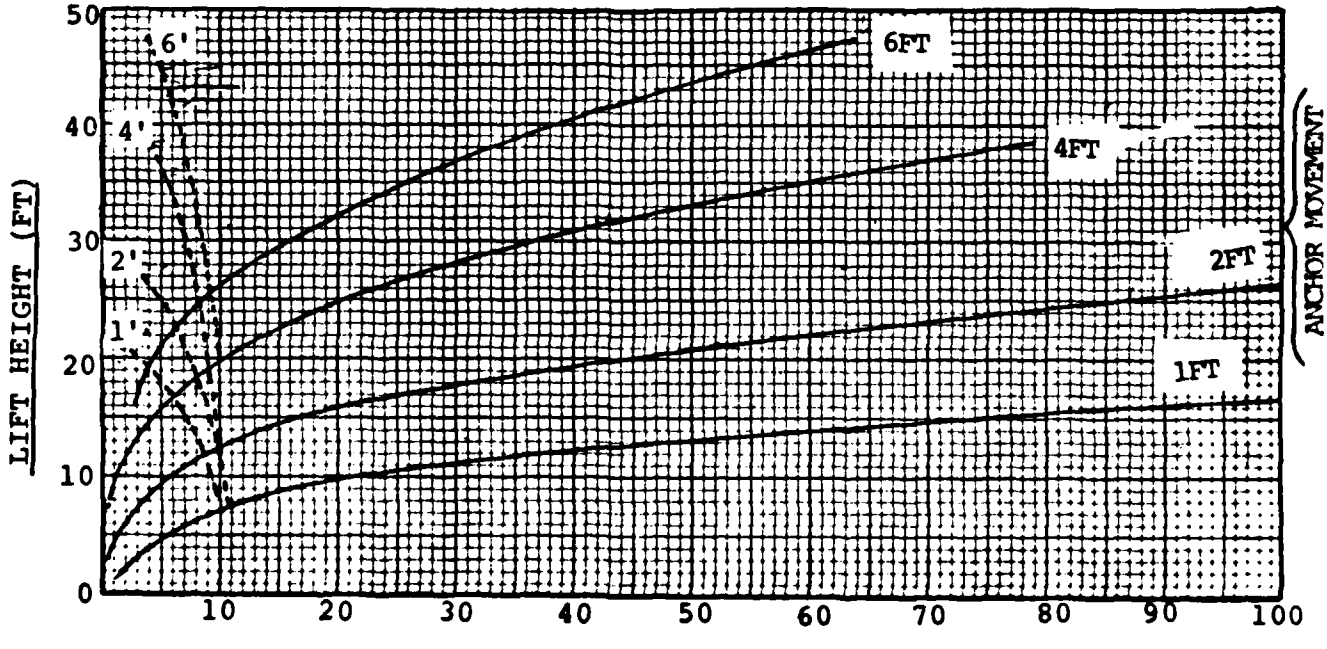
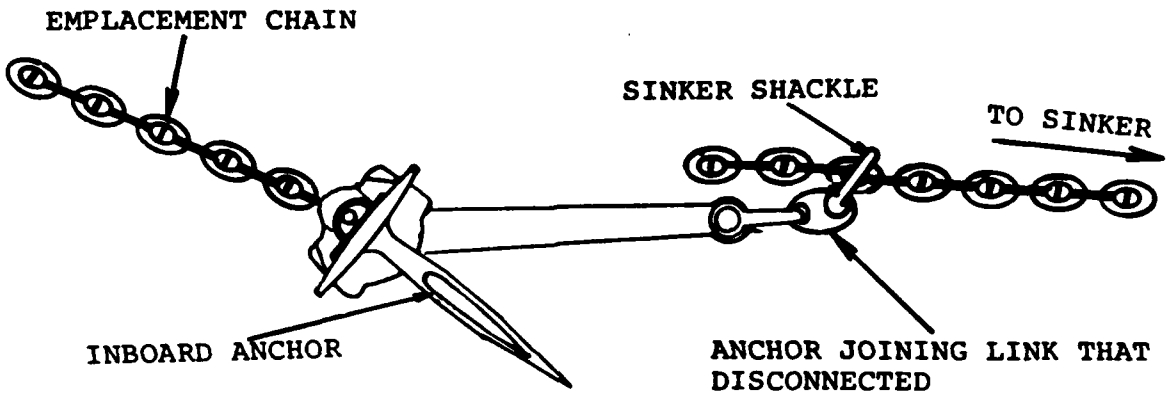


FIGURE 10

LOCATION SKETCH OF THE ANCHOR JOINING LINK

THAT DISCONNECTED DURING INSTALLATION



rigged to the 200 kip dynometer. A search of the 120 ton YD and the PWC barge only produced more 35 ton shackles. Because of this, the lift was performed using the 35 ton shackles up to a maximum load of 85 kips. The buoy was raised to a maximum height of 20 feet, and returned to the water. (See Figure 11.) The height of the lift and the loads attained are recorded in Table 1. When this data is used in Figures 9a & 9b it indicates the mooring is tight. All the quality assurance requirements were met and the mooring was successfully installed.

Thomas J. O'Boyle

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FIGURE 11

RIGGING OF DYNOMETER FOR BUOY LIFT

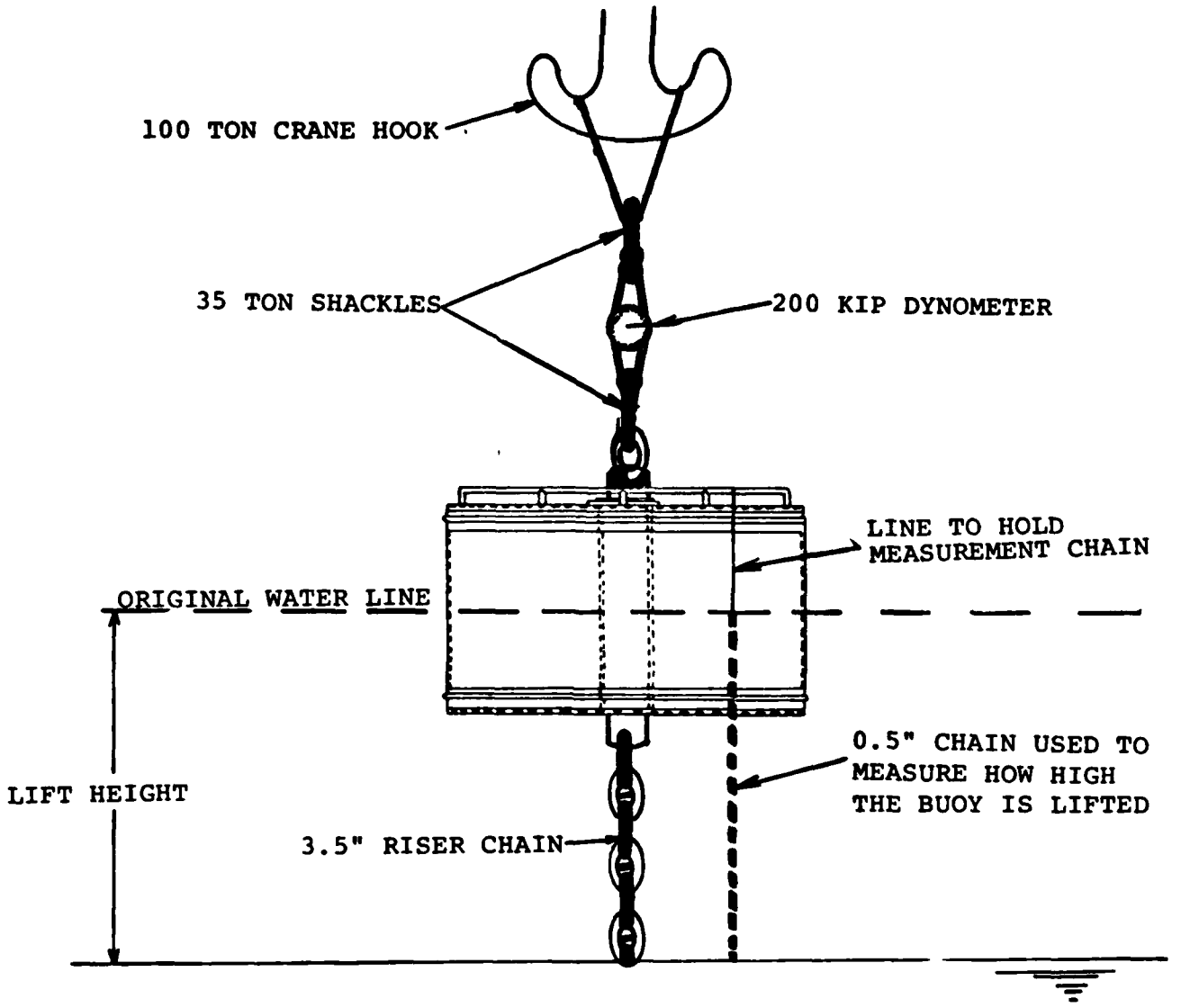


TABLE 1

DATA FROM THE BUOY LIFT

LIFT HEIGHT(FT)	DYNOMETER READING(KIP)
2	15
6	15
6.5	30
7.5	47
8	50
10	50
12	53
15	60
18	70
20	85

FPO-1CP
09A

DEPARTMENT OF THE NAVY
NAVAL ELECTRONIC SYSTEMS COMMAND
WASHINGTON, D.C. 20360

IN REPLY REFER TO
PME-124-612:LL
Ser 639C

SEP 24 1979

From: Commander, Naval Electronic Systems Command
To: Commanding Officer, Chesapeake Division, Naval Facilities Engineering Command

Subj: Proposed Task Assignment for Design of C-C Class Mooring Buoy

Encl: (1) FY 1980 Task Assignment and Milestones

1. Enclosure (1) is a proposed task assignment in support of the Undersea Surveillance Program being implemented by the Project Manager (NAVELEX PME-124). The nature and scope of this task has been mutually discussed previously.

2. For planning purposes, Fiscal Year 1980 funds in the amount of $24,000 are budgeted for this effort. When funds become available they will be authorized by separate correspondence. This letter does not authorize expenditure of funds against this task prior to receipt of an official funding document. When the authorized funds have been expended, work must be terminated and no further changes made against this task.

3. Within ten days after receipt of this letter, written confirmation of task assignment acceptance is required by PME-124. The acceptance letter is to reference this letter. If the task assignment is accepted with reservations, all qualifications or modifications must be included in the acceptance letter. It is to be assumed that all qualifications/ modifications stated in the acceptance letter are concurred in by PME-124 and work will proceed accordingly unless notified in writing ten days from the date of receipt of the task acceptance letter by PME-124-10.

4. Requests for changes to task schedules, funds and scope are to be addressed to PME-124-10. Any reprogramming of funds or redirection of effort must have prior written approval of PME-124-10. Approval to subcontract any portion of this effort must be obtained from PME-124-10 prior to subcontract award.

CDR M. L. MULFORD
By direction of the
Undersea Surveillance Project Manager

Copy to:
PACNAVFACENGCOM (09A)

FY 80 TASK ASSIGNMENT & MILESTONES

Task: Design of CC Class Mooring Buoy

Ref: (a) NAVELEXSYSCOM ltr PME-124-612 Ser S198 of 12 Feb 79
(b) Foncon CDR D. Wells, NAVELEXSYSCOM PME-124-612 and LCDR J. Stamn, CHESNAVFACENGCOM FPO-1 of 14 Sep 79

Background: By reference (a) CHESDIV (FPO-1) was tasked to conduct a feasibility design study of a ship mooring capable of sustaining typhoon conditions. This study resulted in a preliminary design with a modified C-C class mooring identified as the best choice to meet the design conditions. The preliminary design study determined that the mooring, due to its location in shallow water, could be susceptible to failure from dynamic loading conditions. It was recommended that a ship mooring buoy dynamic analysis be performed to quantify this problem and to take positive steps in the final design to eliminate all failure modes resulting from dynamics. By reference (b) it was determined that the cost for the dynamic analysis and final configuration design is estimated to be $24K.

Objective: The objective of this task is to develop a final design for a C-C class mooring to meet the conditions delineated in reference (a) and to provide that design to others for procurement of components and installation. Additionally CHESDIV is to provide consulting and quality assurance services to PACNAVFACENGCOM during the procurement and installation phases.

Milestones:

Preliminary Design Report to PACDIV	15 Oct 79
Initial List of Mooring Components for Procurement	1 Nov 79
Final Design Complete	15 Dec 79
Final List of Mooring Components for Procurement	30 Dec 79
Installation Guidelines and Criteria	30 Mar 80
Final Design Report	30 May 80

ENCLOSURE (1)

Ref (b): encl (2)

JOINT MESSAGEFORM

01 02 3371800 RR RR UUUU

MESSAGE HANDLING INSTRUCTIONS

FROM: CHESNAVFACENGCOM WASHINGTON DC

TO: PACNAVFACENGCOM PEARL HARBOR HI

COMNAVELEXSYSCOM WASHINGTON DC

UNCLAS //N11000//

DESIGN OF "CC" CLASS MOORING BUOY

A. PACNAVFACENGCOM 140510Z NOV 79

B. PHONECON FROM J. ESS AND S. LING (CHESNAVFACENGCOM) TO M. NAGAJI (PACNAVFACENGCOM) OF 30 NOV 79

C. CHESNAVFACENGCOM LTR FPO-1EE:MAK, 9591 OF 22 OCT 79 (NOTAL)

1. IRT REF A, REVISED MILESTONES FOR SUBJECT PROJECT AS FOLLOWS:

FINAL DESIGN COMPLETED	15 JAN 80
FINAL BILL OF MATERIALS FOR PROCUREMENT COMPLETE	15 JAN 80
INSTALLATION SPECIFICATIONS AND DRAWINGS COMPLETE	30 MAR 80
FINAL DESIGN REPORT PACKAGE COMPLETE	30 MAY 80

2. CONFIRMING REF B, A FIRM LIST OF MOORING COMPONENTS WILL BE FORWARDED AT THE TIME OF FINAL DESIGN COMPLETION SCHEDULE FOR 15 JAN 80 PER REF C. IT WAS AGREED DURING REF B THAT

J. O. ESS, FPO-1ED, 33881
3 DEC 79

J. C. WRIGHT, LCDR, CEC, USN

COPIES TO: FPO-1..FPO-1E..FPO-1EA
FPO-1ED..FPO-1ES(FILE)..DAILY..
ROUTE..0166(2)

04134 1662

JOINT MESSAGEFORM

02	02	3371800	RR	RR		UUUU

MESSAGE HANDLING INSTRUCTIONS

THE PRELIMINARY DESIGN AND INITIAL LIST REQUESTED IN REF A AND SCHEDULED IN REF C, WOULD NOT BE OF VALUE TO PACNAVFACENGCOM. INSTEAD, TO MINIMIZE THE PROCUREMENT ITERATION PROCESS BETWEEN DESIGN AND AVAILABLE COMPONENTS, M. NAGAJI AGREED TO SEND CHESNAVFACENGCOM THE CURRENT LIST OF MOORING COMPONENTS IN THE NAVFAC FLEET MOORING INVENTORY. CHESNAVFACENGCOM WILL THEN DESIGN AROUND AVAILABLE HARDWARE WHEREVER POSSIBLE TO MEET THE PERFORMANCE OF THE SHIP/BUOY SYSTEM IN SHALLOW WATER. ANALYSIS OF SHIP MOTION IN SHALLOW WATER IS IN PROCESS AND PREREQUISITE TO FINAL HARDWARE SELECTION.

JOINT MESSAGEFORM

PAGE NO.	DTG/TIME OF RELEASE	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	DIC	FOR MESSAGE CENTER COMMUNICATIONS CENTER ONLY
01 of 04	011512Z	RR	RR		UUUU		

BOOK — MESSAGE HANDLING INSTRUCTIONS

FROM: CHESNAVFACENGCOM WASHINGTON DC

TO: PACNAVFACENGCOM PEARL HARBOR HI

PWC GUAM

UNCLAS //N11000//

PACNAVFACENGCOM FOR CODE 102

FIRM HARDWARE LIST FOR MODIFIED CLASS CC MOORING

A. CHESNAVFACENGCOM WASHINGTON DC 041734Z DEC 79

1. MOORING IS THREE LEG WITH TWO 2.25 INCH GROUND CHAINS PER LEG AND TWO 25K-LB ANCHORS IN TANDEM PER GROUND CHAIN. SINKER IS 15,000 LB CONCRETE POURED ON SITE INTO 4X7X7 FT SHEET IRON OPEN-TOP BOX WITH 5 INCH DIAMETER HAIRPIN (DRAWING FOLLOWS). RISER IS SINGLE 3.5 INCH X 45 FT CHAIN FROM GROUND RING TO PEG TOP BUOY. HAWSER ELASTICITY IS IMPORTANT.

2. MATERIALS LIST PER REF A:

NO.	ITEM	FED. STOCK NO.	QTY.
1	DOUBLE YOKE SHACKLE	SAMSON SPM (14 INCH-15 INCH)	1
2	SHACKLE (100 TON)	CROSBY G 2150/100	3
3	ANCHOR JOINING LINK 3 1/2 INCH	2C-4010-599-8928	10 GUAM

DISTR

CHARTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE	SPECIAL INSTRUCTIONS
1/15/80 C. E. BODEY, FPO-1E, 33881	MINIMIZE CONSIDERED COPIES TO: FPO-1..FPO-1A..FPO-1CP.. FPO-1C6..FPO-1E..FPO-1EA..FPO-1ED6.. DAILY..ROUTE..0161(2)
TYPED NAME, TITLE, OFFICE SYMBOL, PHONE J. C. WRIGHT, LCDR, CEC, USN	
SIGNATURE	SECURITY CLASSIFICATION / DATE TIME GROUP
	161015ZJAN80

DD FORM 173 (OCR)

JOINT MESSAGEFORM

PAGE	DTG/TIME OR RELEASER TIME	PRECEDENCE AUT	PRECEDENCE INFO	LMF	CLASS	DTG	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY
02 of 04	01512002	RR	RR		UUUU		

BOOK — MESSAGE HANDLING INSTRUCTIONS

NO.	ITEM	FED. STOCK NO.	QTY.
4	BUOY PEG TOP, 12 FT X 9 FT - 6 INCH	2C-2050-275-7681	1 GUAM
5	RUBBING CASTING	KZ-4030-640-9620	1
6	BOLT, 3/4 INCH X 16 INCH	G-5306-174-9551	4
7	NUT, 3/4 INCH	G-5310-260-7900	4
8	CHAIN, 3 1/2 INCH	2C-4010-262-2588	45 GUAM
9	JOINING LINK 3 1/2 INCH	BALT P/N 82011-25310	2
10	SWIVEL 3 1/2 INCH	2C-4030-527-8867	1
11	GROUND RING	2C-2040-527-0317	1 GUAM
12	CHAIN SAFETY SHACKLE 3 1/2 INCH	BALT P/N UNKNOWN	1
13	SPIDER PLATE	2C-2040-695-2791	3
14	ANCHOR JOINING LINK 2 1/4 INCH	2C-4010-391-0534	30 GUAM
15	CHAIN 2 1/4 INCH (90 FT SHOT)	2C-4010-240-1030	30 SHOTS GUAM
16	ANCHOR 25,000 LB WITH STABILIZERS	C-2040-272-2242	12 (1) GUAM
17	SINKER SHACKLE	2C-4030-267-7076	6 GUAM
18	SINKER	NO PART NO., TO BE CONSTRUCTED ON SITE	1

6 5 4 3 2 1 0

DISTR

0

AUTH (TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE) | SPECIAL INSTRUCTIONS

RELEASER (TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE)

SIGNATURE | SECURITY CLASSIFICATION | DATE/TIME GROUP

DD FORM 173 (OLD)

JOINT MESSAGEFORM

SECURITY CLASSIFICATION

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER COMMUNICATIONS CENTER ONLY DATE-TIME	MONTH	YR
03 of 04	0151200	RR	RR		UUUU				

BOOK | MESSAGE HANDLING INSTRUCTIONS

NO.	ITEM	FED. STOCK NO.	QTY.
19	SWIVEL 2 1/4 INCH	2C-4030-527-8864	6
20	JOINING LINK 2 1/4 INCH	2C-4010-391-0542	24 {7} GUAM
21	PAINT, PRIMER	8010-437-6757	10 GALLONS
22	PAINT, WHITE TOP COAT {ITEMS 24, 25 PER MIL-P-24441}	8010-421-2435	5 GALLONS
23	LOCK WASHERS, 3/4 INCH	G5310-013-8506	4
24	SHIPS HAWSER, SIZE 4 1/4 }, 150 L.F. EYE TO EYE, WITH SAMSON SPM STAINLESS THIMBLE EACH END, 2 IN 1 NYLON LINE {13 INCH CIRCUMFERENCE}	SAMSON	2

{N} INDICATES PARTIAL QUANTITY AT GUAM

MIN. SPARES ARE IN ABOVE QUANTITIES.

3. ANCHORS ARE NAVY STOCKLESS WITH STABILIZERS AND WITH FLUKES WEDGED AND FIXED AT 45 DEGREES. EACH TANDEM SET OF ANCHORS MUST HAVE TOTAL WEIGHT OF 50,000 LBS {25 PLUS 25} OR {30 PLUS 20} OR {30 PLUS 25}.

4. MOORING SITE IS APPROXIMATELY 500 FT EAST OF EXISTING 25N/25S

DISTR

DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE

SPECIAL INSTRUCTIONS

RELEASER | TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE | SIGNATURE | SECURITY CLASSIFICATION | DATE-TIME GROUP

DD FORM 173 JUN

JOINT MESSAGEFORM

PAGE	DRAFTER OR RELEASER TIME	PRECEDENCE ACT	PRECEDENCE INFO	LMF	CLASS	CIC	FOR MESSAGE CENTER/COMMUNICATIONS CENTER ONLY
04 OF 04	0151200	RR	RR		UUUU		

MESSAGE HANDLING INSTRUCTIONS

LOCATIONS.

FROM

5. INSTALLATION REQUIRES DIVERS, 100,000 LB HORIZONTAL PULL TO SET ANCHORS AND 40,000 LB VERTICAL LIFT ON SITE. DETAILS WITH SINKER SKETCH AND CONFIGURATION SCHEMATICS FOLLOW WITHIN TWO WEEKS.

6. CHESDIV CONTACTS ARE CODES FPO-1E AND/OR FPO-1ED.

DISTR

DRAFTER TYPED NAME, TITLE, OFFICE SYMBOL, PHONE & DATE

SPECIAL INSTRUCTIONS

TYPED NAME, TITLE, OFFICE SYMBOL AND PHONE

SIGNATURE

SECURITY CLASSIFICATION

DATE TIME GROUP

DD FORM 173

R[illegible] (d); encl (4)

FPO-1E:bw
11000
17 JAN 1980

From: Commanding Officer, Chesapeake Division,
Naval Facilities Engineering Command
To: Commander, Pacific Division,
Naval Facilities Engineering Command
(Attention: Code 102)

Subj: EC-2 Typhoon Survival Mooring

Ref: (a) CHESNAVFACENGCOM Washington DC 161615Z Jan 80
(b) CHESNAVFACENGCOM Washington DC 041734Z Dec 79

Encl: (1) Procurement and Installation Information

1. This is in follow-up to reference (a) to provide supplementary information in support of procurement and installation of the subject mooring in Apra Harbor.

2. The final design calculations and anchor requirements analyses have been completed. The design provides the elasticity and energy absorption characteristics required for EC-2 ship-survival under typhoon conditions in the shallow water of Apra Inner Harbor, Guam. The tandem anchor requirement reflects knowledge of sea floor characteristics from prior surveys and mooring inspections. It also reflects communications with Mr. R. S. Taylor of the Civil Engineering Laboratory (CEL) based on recent findings on the performance of Navy stockless anchors with stabilizers in a tandem configuration.

3. The mooring configuration is a three-legged array with two ground chains per leg as in a DM-28 Class CC mooring. Each ground chain terminates in a pair of tandem anchors. At the other end of the six chain legs, the termination is at a common ground ring. A single 15,000 pound (SW) sinker is attached directly to the ground ring; and a 3.5-inch riser chain connects the ground ring through the hawse pipe of a 12 foot diameter peg top buoy to the end link on top of the buoy. The hawser from the buoy to the ship is a dual parallel nylon rope which is sized to absorb the pitch and heave motion of an EC-2.

FPO-1E:bw
11000
17 JAN 1980

Subj: EC-2 Typhoon Survival Mooring

4. Enclosure (1) provides:

(a) a copy of the Bill of Materials (B/M) for the mooring

(b) a sketch which identifies the components and their location in the array

(c) preliminary notes on Installation Support Requirements

(d) catalog cuts (Samson, Baldt, and Crosby components called out in the B/M).

5. The mooring location is approximately 500 feet east of the existing 25N/25S moorings. This accommodates the watch circle of the free-swinging EC-2 and potentially meets the sea floor sediment requirements for anchoring. The maximum watch circle radius of the buoy is 180 feet at 200,000 pounds horizontal load. Ship length adds 430 feet to this swing radius.

6. Anchoring verification test(s) will be required at the new site to validate the tandem anchor holding power at the site. The test(s) could be accomplished with CEL in March during their soft-soil anchor tests at PWC Guam; but these details have not yet been worked out by CHESDIV FPO-1.

7. The calculated coupled pitch and heave at the bow of the ship is estimated to be $\pm$ 3 feet. The minimum water depth is estimated to be 28 feet with low tide and a five foot allowance for storm surge. Therefore, the ground clearance of the bow to the sea floor is expected to be about five feet assuming 20 feet of draft on the ship.

8. Additional details including a sinker design sketch will be released by 31 January 1980. For answers to any questions, please contact CHESDIV FPO-1E and/or FPO-1ED on Autovon 288-3881.

C. E. BODEY
By direction

Copy to:
PWC Guam
FPO-1
FPO-1A
FPO-1CP
FPO-1E
FPO-1EA
FPO-1ED
FPO-1ED6
Daily
Route
0161(2)

CONTRACT NO. ----------

ESTIMATE ON

SWING MOORING, DESIGN LOAD 200K (FINAL P/L 1-15-80)

LOCATION
APRA HARBOR, GUAM

NO.	ITEM	FED. STOCK NO.	QUANTITY	(EA) WT	UNIT PRICE MATERIAL	LOCATION	TOTAL UNIT PRICE	SUBTOTAL	TOTAL
1	DOUBLE YOKE SHACKLE	SAMSON SPM (14"-15")	1		$	-	$	$	$
2	SHACKLE (100 TON)	CROSBY G2150/100	3			-			
3	ANCHOR JOINING LINK 3½	2C-4010-599-8928	9			GUAM			
4	BUOY PEG TOP 12'x9'-6"	2C-2050-275-7681	1			GUAM			-0-
5	RUBBING CASTING	KZ-4030-640-9620	1			-			
6	BOLT, 3/4" x 16"	G-5306-174-9551	2			-			
7	NUT, 3/4"	G-5310-260-7900	2			-			-0-
8	CHAIN 3½"	2C-4010-262-2588	45'			GUAM			
9	JOINING LINK 3½"	BALT P/N 82011-25310	2	205	830	-	-	-	1660
10	SWIVEL 3½"	2C-4030-527-8867	1			-			
11	GROUND RING	2C-2040-527-0317	1		-	GUAM	-	-	-
12	CHAIN SAFETY SHACKLE 3½"	BALT P/N UNKNOWN	1	241		-			
13	SPIDER PLATE	2C-2040-695-2991	3			-			
14	ANCHOR JOINING LINK 2¼"	2C-4010-391-0534	30			GUAM			
15	CHAIN 2¼" (90' SHOT)	2C-4010-240-1030	24 SHOTS			GUAM			
16	ANCHOR 25,000 lb	C-2040-272-2242	12			GUAM (1)			
	WITH STABILIZERS								
17	SINKER SHACKLE	2C-4030-267-7076	6			GUAM			
18	SINKER	NO PART NO., TO BE	1						
		CONSTRUCTED ON SITE							
19	SWIVEL 2¼"	2C-4030-527-8864	6			-			
20	JOINING LINK 2¼"	2C-4010-391-0542	18			GUAM (7)			

PREPARED BY Keith R Coalter 1-19-80

REVIEWED BY

DATE

NAVFAC ESDIV 3-4250/1 (Rev. 8-68) FOR OFFICIAL USE ONLY DATE

CONTRACT NO. ---------- ESTIMATE ON SWING MOORING, DESIGN LOAD 200K

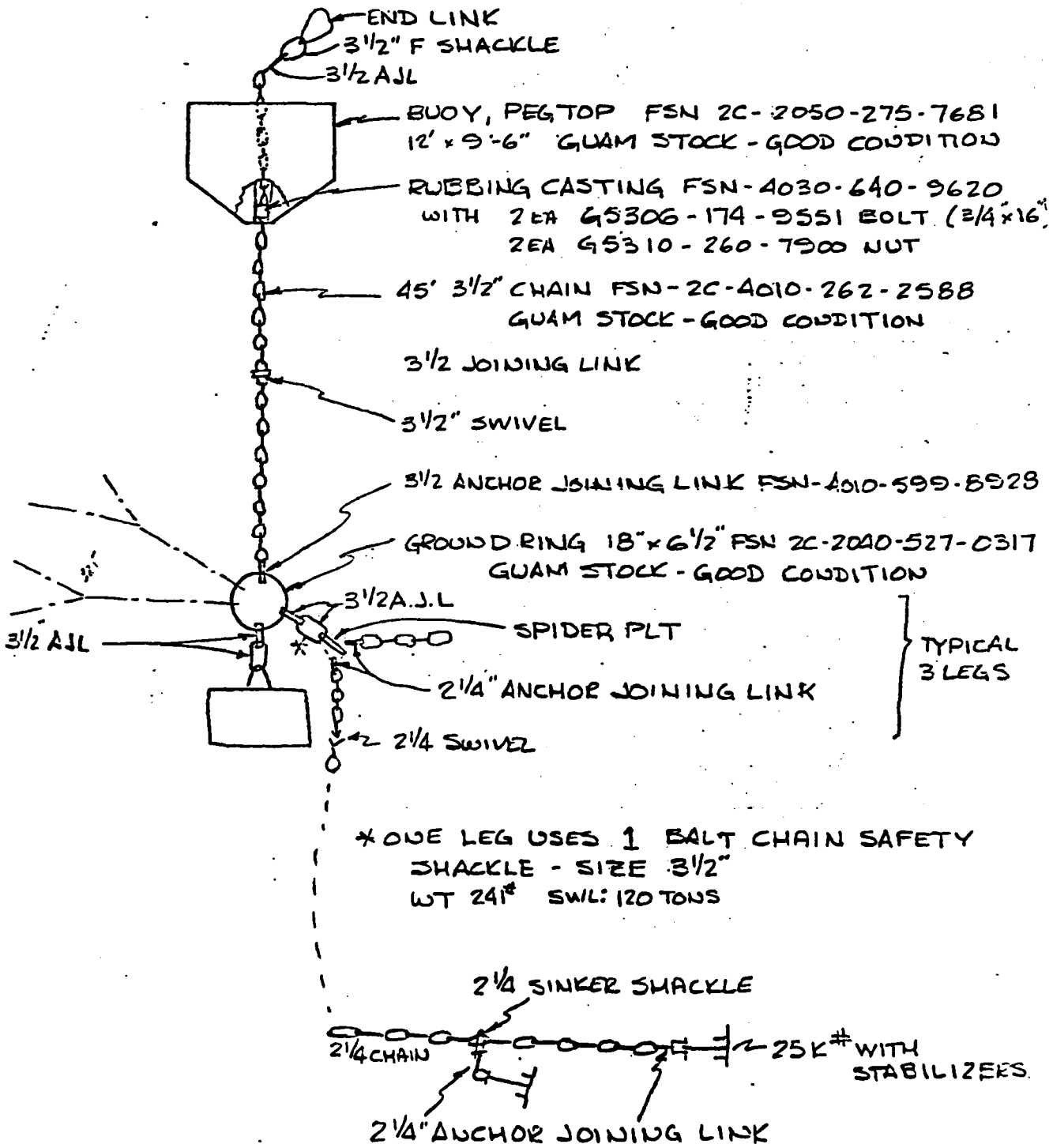
LOCATION APRA HARBOR, GUAM

NO.	ITEM	FED. STOCK NO.	QUANTITY	WT EACH	UNIT PRICE MATERIAL	LOCATION	TOTAL UNIT PRICE	SUBTOTAL	TOTA
					$		$	$	$
	WIRE ROPE 3/4" IWRC GALVANIZIED	NONE	2200 L.F						
	CLAMPS - CUSTOM MADE	NONE	220						
	ZINC ANODE 150 LB.	PER MIL-A-18001H (HARO FZ-150 OR EQUAL)	16						
21	PAINT, PRIMER	8010-437-6757	10 GALLONS						
22	PAINT, WHITE TOP COAT (ITEMS 24, 25 PER MIL-	8010-421-2435 P-24441)	5 GALLONS						
23	SHIPS HAWSER, SIZE 4 1/4 ø 150 L.F. EYE TO EYE, WITH SAMSON SPM STAINLESS THIMBLE EACH END, 2 IN 1 NYLON LINE (13" CIRCUMFERENCE)	SAMSON	2						

PREPARED BY REVIEWED BY DATE

Project GUAM MOORING Item No. _____

Description BM Date 1-19-80 Sheet No. _____



Project Mooring - Apra Harbor, Guam Item No. ____

Description Installation Date 1-14-50 Sheet No. 1/1

KRCoalbran

Installation Support Requirements

A. Lift capacity - A floating work platform having a lift capacity of 40,000 lbs. Deck space must support two 25,000 lb anchors and 350 ft of 2 1/4" chain having a weight of 15,500 lbs. The work platform will require support from a harbor tug.

B. Staging area - The staging area will require a lift capacity of 40,000 lbs and provisions for moving mooring components from the staging area to the floating work platform.

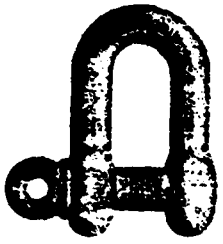
C. Pulling capacity - The mooring design is based upon "setting" the anchors prior to ship loading. Loads to set the anchors a tension of 100,000 lbs. is required to be applied to each leg. The tension load can be applied by ship pull or by the use of a moored pulling barge containing a pulling winch or beach gear assembly.

Use of the pulling barge would extend installation time as compared to having a ship pull each leg.

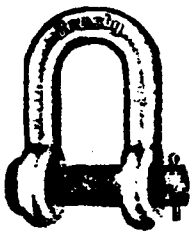
D. Divers - Divers are required for installation survey and attaching mooring components underwater.

E. Survey - An accurate site survey requirement must be provided to establish installation

FORGED SHACKLES

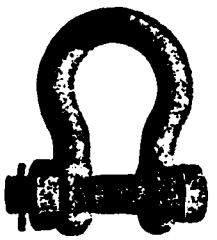


G-210 S-210
Screw pin chain shackles meet Federal Specification RR-C-271b Type IV Class 2.

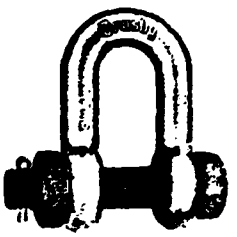


G-215 S-215
Round pin chain shackles meet Federal Specification RR-C-271b Type IV Class 5.

Load Rated



G-2130 S-2130
Bolt type anchor shackles with thin head bolt — nut with cotter pin. Meets Federal Specification RR-C-271b Type IV Class 6.



G-2150 S-2150
Bolt type chain shackles. Thin hex head bolt — nut with cotter pin.

CHAIN SHACKLES — ROUND PIN & SCREW PIN.

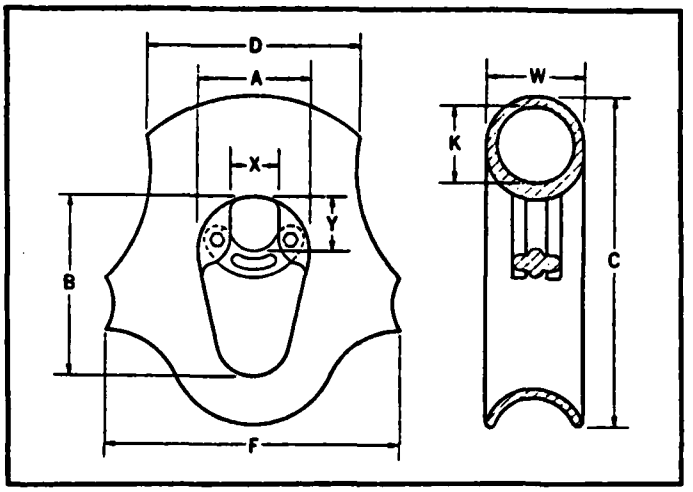
Safe Working Load Tons	Nominal Shackle Size Inches	DIMENSIONS IN INCHES: Inside Length	Inside Width at Pin	Tolerance Plus or Minus: Length	Width	Diameter: Pin	Outside of Eye	Weight Pounds Each
½	¼	⅞	15/32	1/16	1/16	5/16	11/16	.10
¾	5/16	1 1/32	17/32	1/16	1/16	⅜	13/16	.18
1	⅜	1¼	21/32	⅛	1/16	7/16	31/32	.25
1½	7/16	1 7/16	23/32	⅛	1/16	½	1 1/16	.41
2	½	1⅝	13/16	⅛	1/16	⅝	1 3/16	.61
3¼	⅝	2	1 1/16	⅛	1/16	¾	1 9/16	1.21
4¾	¾	2⅜	1¼	¼	1/16	⅞	1⅞	2.12
6½	⅞	2 13/16	1 7/16	¼	1/16	1	2⅛	3.28
8½	1	3 3/16	1 11/16	¼	1/16	1⅛	2⅜	4.63
9½	1⅛	3 9/16	1 13/16	¼	1/16	1¼	2⅝	6.30
12	1¼	3 15/16	2 1/32	¼	⅛	1⅜	3	9.24
13½	1⅜	4⅜	2¼	¼	⅛	1½	3 5/16	12.19
17	1½	4 13/16	2⅜	¼	⅛	1⅝	3⅝	16.15
25	1¾	5¾	2⅞	¾	⅛	2	4⅛	26.96
35	2	6¾	3¼	¾	⅛	2¼	5	39.35
*55	2½	8	4⅛	¾	¼	2¾	6	71.00

*Furnished in Screw Pin Only.

BOLT TYPE ANCHOR & CHAIN SHACKLES

Safe Working Load Tons	Nominal Shackle Size Inches	DIMENSIONS IN INCHES: Inside Length 2130	Inside Length 2150	Inside Width at Pin	Diameter: Pin	Outside of Eye	Tolerances Plus or Minus: Length	Width	Weight Pounds Each: 2130	2150
2	½	1⅞	1⅝	13/16	⅝	1 3/16	⅛	1/16	.79	.75
3¼	⅝	2⅜	2	1 1/16	¾	1 9/16	⅛	1/16	1.60	1.47
4¾	¾	2 13/16	2⅜	1¼	⅞	1⅞	¼	1/16	2.72	2.52
6½	⅞	3 5/16	2 13/16	1 7/16	1	2⅛	¼	1/16	3.95	3.83
8½	1	3 3/4	3 3/16	1 11/16	1⅛	2⅜	¼	1/16	6.12	5.55
9½	1⅛	4 1/16	3 9/16	1 13/16	1¼	2⅝	¼	1/16	8.27	7.60
12	1¼	4 15/16	3 15/16	2 1/32	1⅜	3	¼	1/16	11.71	10.81
13½	1⅜	5 1/16	4⅜	2¼	1½	3 5/16	¼	⅛	15.83	14.26
17	1½	5 3/16	4 13/16	2⅜	1⅝	3⅝	¼	⅛	20.80	19.03
25	1¾	7	5¾	2⅞	2	4⅛	¾	⅛	33.91	31.40
35	2	7¾	6¾	3¼	2¼	5	¾	⅛	51.75	45.00
55	2½	10½	8	4⅛	2¾	6	¾	¼	101.59	83.59
85	3	13	8½	5	3¼	6½	¼	¼	178	139.00
*120	3½	14 5/16	—	5¼	3¾	8	¼	¼	265	—
*150	4	14½	—	5½	4¼	9	⅛	¼	338	—

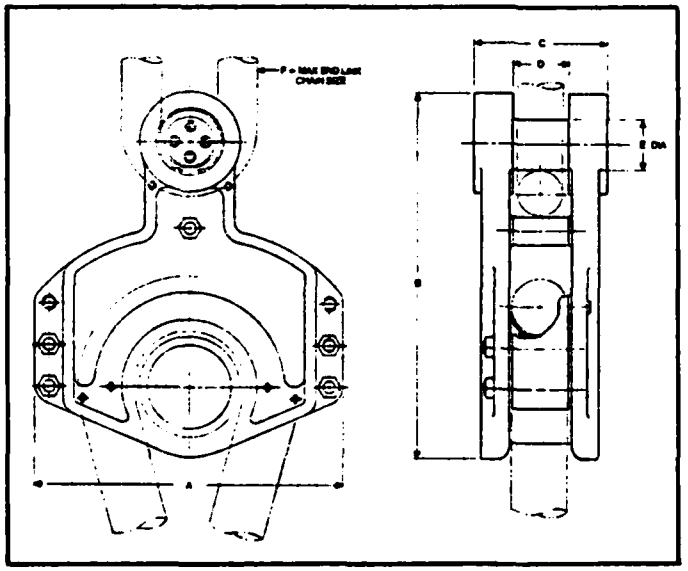
NOTE: Proof Load is 2.2 times the Safe Working Load. Minimum Ultimate Load is 6 times the Safe Working Load.
*Furnished Anchor Shackle only.



Samson SPM Stainless Thimble

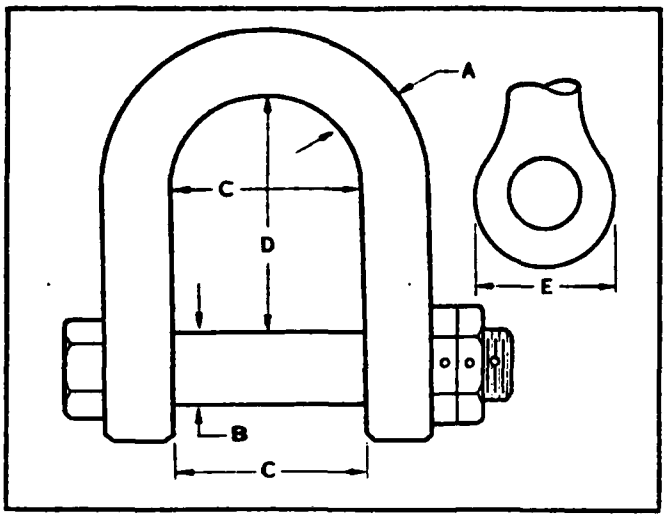
FOR ROPE SIZE CIRC.	DIA.	Wt., Lbs.*	A	B	C	D	F	K	W	X	Y	CONSTRUCTION
11" - 13"	3⅝" - 4¼"	105	6 1/16"	10¾"	21"	13"	18¾"	5 5/16"	6"	3½"	3⅜"	High strength casting corrosion resistant stainless steel Type 304.
14" - 15"	4⅝" - 5"	135	10	15	26	19	24	6	7	4	4⅞	
16" - 18"	5¼" - 6"	250	12	18	31¼	21½	28¼	7¼	8¼	5	5¾	
19" - 21"	6¼" - 7"	500	14	21	38	26	34½	8½	10	6½	7⅜	
22" - 25"	7¼" - 8¼"	700	17	25	45	32	42	10	12	7¾	8½	
26" - 30"	8½" - 10"	1000	20	30	54	41	51	12	14	9	9½	
6" - 6½"	2" - 2 1/8"	8¼	3	5¼	9¾	6	8¾	2 ¼	2¾	No retaining clevis for 6" -10" circ. bronze thimbles		Sizes 6" to 10" circ. available only in cast bronze. Mil. Spec. B-24480 (ships).
7" - 8"	2¼" - 2⅜"	20	4 7/16	7	12⅜	7⅛	11	2 15/16	3⅜			
8½" - 10"	2¾" - 3¼"	41	5⅜	8½	15⅞	10½	14⅜	3¾	4½			

Note: Also available in high strength Dura-Steel. Specifications available on request. Sizes 11"—30" only.
*Without Retaining Ring



Samson Quick Change Plate Thimble

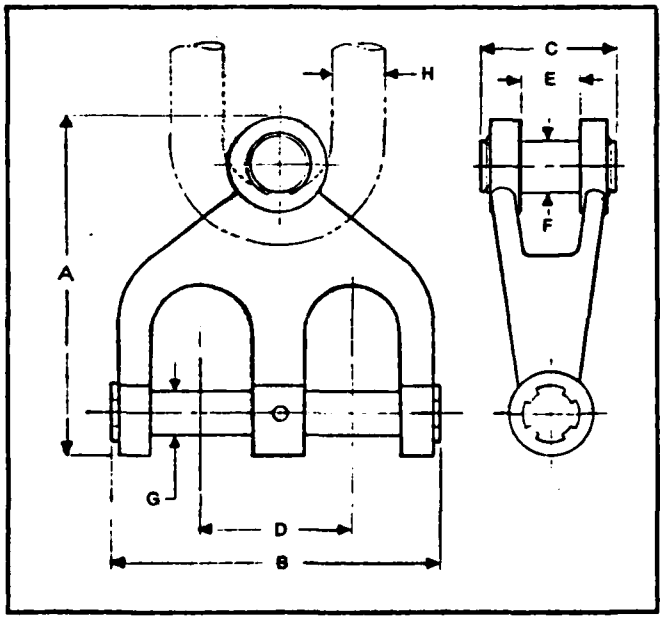
ROPE SIZES CIRC.	A	B	C	D	E	F
14" - 15"	27½	32¾	12	5	4½	3 7/16
16" - 18"	32	40	13½	6	5	4
19" - 21"	37½	46	16¼	7½	5½	5



Samson Heavy-Duty Shackle

FOR THIMBLE SIZE	WT. LBS.	A	B	C	D	E	SWL[1] TONS	CONSTRUCTION
6" - 6½"	27	1½	1¾	3	6	3¾	20	Forged of 4340 A1S1 steel. Exceeds Grade 3 strength requirements. Shackles include pins with two safety nuts, secured with cotter bolts to prevent backing out. Larger sizes: Available upon request. Available with one safety nut if preferred. Other types and sizes available at standard costs.
7" - 8"	30	1½	1¾	4	7	4	20	
8½" - 10"	60	2	2¼	5	8	5	35	
11" - 13"	130	2½	3	7	10	6½	60	
14" - 15"	175	3	3½	7¾	12	7	85	
16" - 18"	300	3½	4	9¼	14	8¼	110	
19" - 21"	400	4	4½	11	16	9¼	130	
22" - 25"	550	4½	5	13	18	10½	155	
26" - 30"	750	5	6	15	20	12	235	

[1]Safe Working Load, Short Tons. Proof Load 1.5 times SWL, Breaking Strength 5 times SWL (minimum).



Samson SPM Double Yoke Shackle

ROPE SIZES CIRC.	A	B	C	D	E	F	G	MAX LINK SIZE H
11" - 13"	22¼	21	8	9½	3¼	3	2⅛	3
14" - 15"	25¼	25½	9¾	11⅞	4	3¼	3	3¼
16" - 18"	32⅛	31¼	12¾	14½	5½	5¼	4¼	5¼
19" - 21"	42½	37	15¾	17¾	6½	7	5¾	6

Samson Braided Rope Selection Guide

2-in-1 NYLON

Braided Nylon cover and braided Nylon core.

Special Features:
- Highest strengths, size for size, to 2,133,000 lbs.
- Controlled stretch. Up to 50% less than twisted or plaited, but more than Power Braid, Stable Braid, or Dura-Plex.
- Specified by U.S. Coast Guard, Canadian M.O.T., and U.S. Navy.
- Specific gravity of 1.14.
- Conforms to U.S. Mil Spec MIL-R-24050B, dated 7 August 1973.
- Conforms to Canadian Spec 40-GP-16 Type 1/MOT. — NATO Class 4020 Supp. 1972.

POWER BRAID

Braided Nylon cover over braided MFP Polypropylene core.

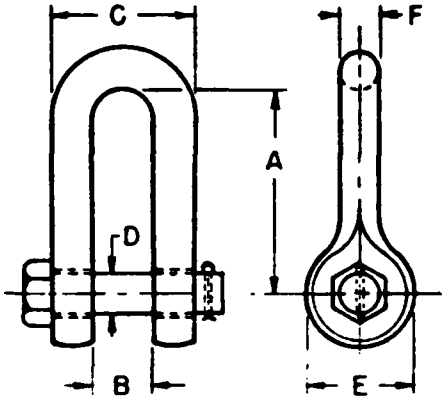
Special Features:
- Neutrally buoyant in salt water.
- Specific gravity of 1.01. Available with .99.
- Abrasion resistant nylon cover.
- Highest strength rope using polypropylene.
- Light weight, high strength to weight ratios.
- Identified by blue stripe. Can also be color coded.
- Conforms to Canadian Spec 40-GP-16 Type 2/MOT. — NATO Class 4020 Supp. 1972.

U.S. MEASURE		2-in-1 NYLON (Nylon-Nylon)		2-in-1 POWER BRAID (Nylon-Polypropylene)		2-in-1 STABLE BRAID (Polyester-Polyester) with DURON		DURA-PLEX(TM) 12-STRAND BRAID (Polyester-Polyolefin)	
Diameter Inches	Circumference Inches	Tensile (1) Pounds	Weight lbs. /100 ft.	Tensile (1) Pounds	Weight lbs. /100 ft.	Tensile (1) Pounds	Weight lbs. /100 ft.	Tensile (1) Pounds	Weight lbs. /100 ft.
1/4"	3/4"	2,300	1.65	2,300*	1.65*	2,300	2.0	1,990	1.75
5/16"	1"	3,400	2.6	3,400*	2.6*	3,400	3.0	2,600	2.4
3/8"	1-1/8"	4,900	3.7	4,400	3.3	4,900	4.4	3,880	3.5
7/16"	1-1/4"	6,600	5.1	5,900	4.5	6,600	6.0	5,200	4.8
1/2"	1-1/2"	8,500	6.6	7,600	5.9	8,500	7.9	6,700	6.0
9/16"	1-3/4"	11,700	9.0	10,200	8.2	11,500	10.7	9,000	8.1
5/8"	2"	15,200	12.0	13,000	10.4	14,600	14.0	11,600	10.6
3/4"	2-1/4"	19,100	15.0	16,400	13.2	18,400	18.0	14,500	13.5
13/16"	2-1/2"	23,500	18.0	20,000	16.2	22,600	22.0	17,700	—
7/8"	2-3/4"	28,300	22.0	24,000	19.7	27,000	27.0	21,200	20.2
1"	3"	33,600	26.0	28,400	23.4	31,400	32.0	25,000	24.0
1-1/16"	3-1/4"	39,300	31.0	33,000	27.5	36,500	37.0	29,100	28.0
1-1/8"	3-1/2"	45,000	36.0	38,000	32.0	42,800	43.0	33,500	32.6
1-1/4"	3-3/4"	52,000	41.0	43,400	37.0	48,000	49.0	38,200	37.4
1-5/16"	4"	59,000	47.0	49,000	42.0	54,400	56.0	43,200	42.5
1-1/2"	4-1/2"	74,800	60.0	61,300	53.0	68,000	71.0	54,000	54.0
1-5/8"	5"	91,000	74.0	75,000	65.0	83,800	88.0	66,000	67.0
1-3/4"	5-1/2"	110,000	89.0	90,000	79.0	100,200	106.0	79,100	81.0
2"	6"	131,000	106.0	106,000	94.0	117,800	126.0	93,300	96.0
2-1/8"	6-1/2"	153,000	124.0	123,000	110.0	137,000	148.0	109,000	112.0
2-1/4"	7"	177,000	144.0	142,000	127.0	157,000	172.0	125,000	130.0
2-1/2"	7-1/2"	202,000	165.0	162,000	146.0	180,000	197.0	143,000	150.0
2-5/8"	8"	230,000	188.0	183,000	166.0	200,000	224.0	160,000	170.0
2-3/4"	8-1/2"	257,000	212.0	204,000	188.0	223,000	253.0	180,000	192.0
3"	9"	285,000	238.0	227,000	211.0	250,000	284.0	200,000	215.0
3-1/4"	10"	322,000	294.0	276,000	260.0	280,000	350.0	244,000	265.0
3-5/8"	11"	384,000	356.0	329,000	315.0	336,000	424.0	290,000	321.0
4"	12"	451,000	423.0	387,000	374.0	396,000	504.0	337,000	382.0
4-1/4"	13"	523,000	497.0			461,000	592.0	—	—
4-5/8"	14"	599,000	576.0	Larger		531,000	686.0	—	—
5"	15"	680,000	662.0	Sizes		606,000	788.0	—	—
5-1/4"	16"	766,000	753.0	Through 30" Cir.		685,000	896.0	—	—
5-1/2"	17"	856,000	850.0	Available		768,000	1,012.0	—	—
6"	18"	950,000	953.0	based		857,000	1,134.0	—	—
6-1/4"	19"	1,050,000	1,061.0	on		949,000	1,264.0	—	—
6-1/2"	20"	1,152,000	1,176.0	Specific		1,050,000	1,400.0	—	—
7"	21"	1,260,000	1,297.0	Gravity		1,150,000	1,544.0	—	—
8"	24"	1,425,000	1,693.0	And Strength		1,250,000	2,016.0	—	—
8-1/2"	25"	1,647,000	1,987.0	Requirements		1,440,000	2,366.0	—	—
9-1/4"	28"	1,884,000	2,305.0			1,640,000	2,744.0	—	—
10"	30"	2,133,000	2,646.0			1,850,000	3,150.0	—	—

(1) All Tensile data is for New Rope under test conditions

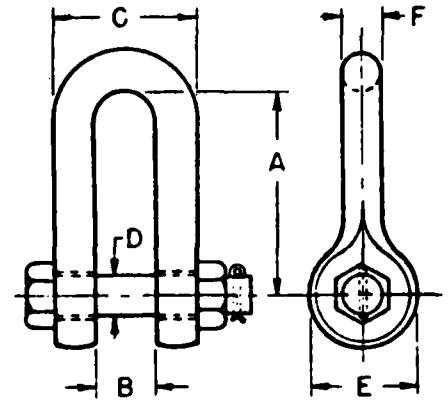
Strengths and weights are Approximate Averages *Nylon Cover — Nylon Core

BALDT CHAIN SHACKLE ROUND PIN TYPE



SHACKLE SIZE		A	B	C	D	E	F	WEIGHT LBS.	SAFE WORKING LOAD TONS
INCHES	MM								
1	25	3¾	1 1/16	3 1/16	1⅛	2⅜	1	6	8.5
1¼	32	4⅝	2 1/32	4 1/32	1⅜	3	1¼	11	12
1½	38	5 1/16	2⅜	5⅜	1⅝	3⅝	1½	19	17
2	51	7⅞	3¼	7¼	2¼	5	2	45	35
2½	64	9⅜	4⅛	9⅛	2¾	6	2½	84	55
3	76	10⅛	5	11	3¼	6½	3	139	85
3½	89	12⅜	5¼	12¼	3¾	8	3½	241	120
4	102	19	5¾	13¾	4	9½	4	339	150
4½	114	22	6¾	15¾	4½	10¾	4½	466	190

BALDT CHAIN SHACKLE SAFETY TYPE



SHACKLE SIZE		A	B	C	D	E	F	WEIGHT LBS.	SAFE WORKING LOAD TONS
INCHES	MM								
1	25	3¾	1 1/16	3 1/16	1⅛	2⅜	1	6	8.5
1¼	32	4⅝	2 1/32	4 1/32	1⅜	3	1¼	11	12
1½	38	5 1/16	2⅜	5⅜	1⅝	3⅝	1½	19	17
2	51	7⅞	3¼	7¼	2¼	5	2	45	35
2½	64	9⅜	4⅛	9⅛	2¾	6	2½	84	55
3	76	10⅛	5	11	3¼	6½	3	139	85
3½	89	12⅜	5¼	12¼	3¾	8	3½	241	120
4	102	19	5¾	13¾	4	9½	4	339	150
4½	114	22	6¾	15¾	4½	10¾	4½	466	190

Ref (e); encl (5)

FPO-1:bw
11000
[illegible]

From: Commanding Officer, Chesapeake Division
Naval Facilities Engineering Command
To: Commander, Pacific Division
Naval Facilities Engineering Command
(Attention: Code 102)

Subj: EC-2 Typhoon Survival Mooring

Ref: (a) CHESNAVFACENGCOM ltr FPO-1E:bw, Ser 11000, 17 Jan 1980

Encl: (1) Sinker Design Sketch
(2) Quality Control Requirements
(3) Installation Scenario Outline

1. Initial procurement and installation information was provided via reference (a). Sinker design per reference (a), para 8 is provided as enclosure (1).

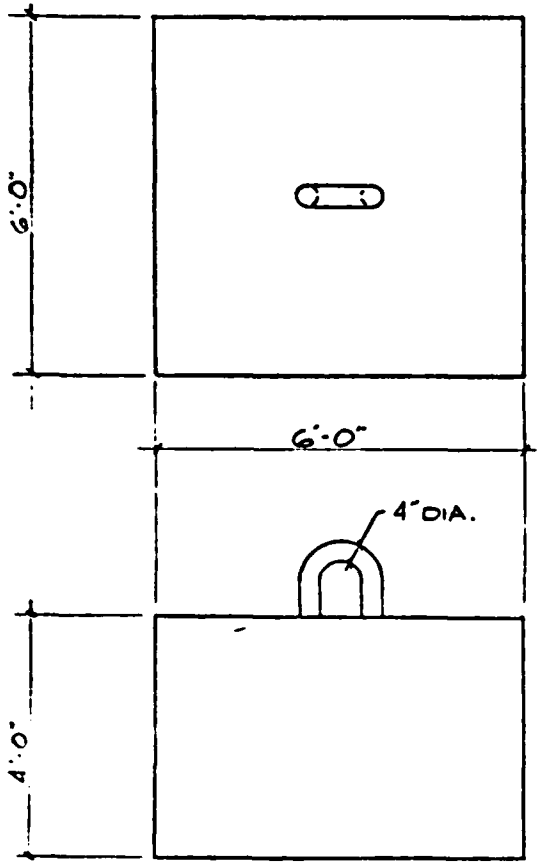
2. Quality control requirements (enclosure (2)) and an installation scenario outline (enclosure (3)) are provided to be used as a basis for procurement and installation. The importance of the QC function was recently found to be extremely important in assuring acceptable quality of available hardware from Navy stock for a similar critical design mooring.

J. A. STAMM
By direction

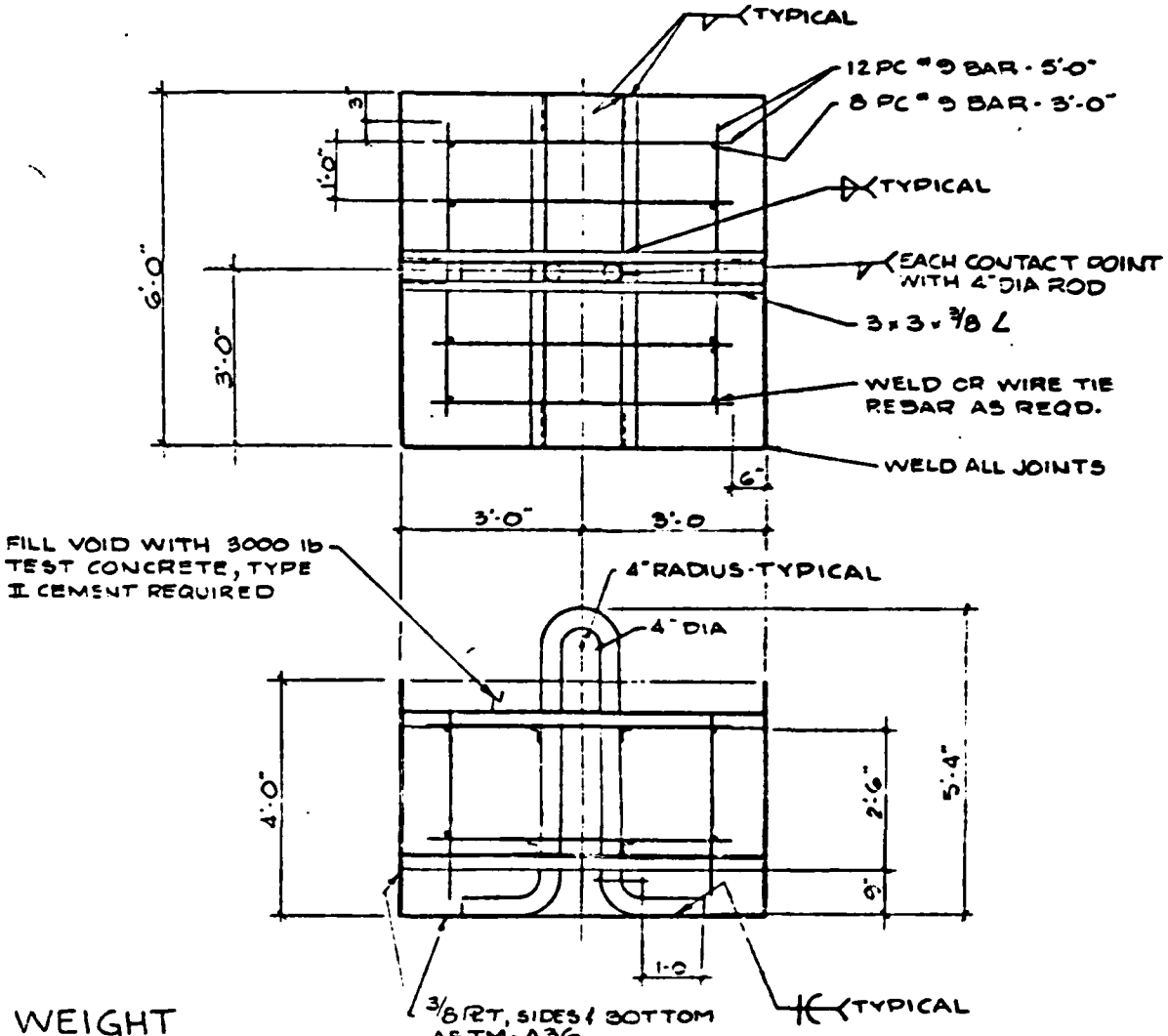
Copy to:
FPO-1
FPO-1E
FPO-1ED
FPO-1ED6
Daily
Route
0161(2)

ENCLOSURE (2)

Encl (1)



PLAN



INTERNAL STRUCTURE
SCALE 1/2" = 1'-0"

SINKER WEIGHT
EST WT - 23,700# AIR WT
14,200# WATER WT
DES - KEITH COOPER 2-8-80
CHESNAVFAC (FPO-1)

SKC 2650

QUALITY CONTROL REQUIREMENTS

1. Fit and Function - The parts listed in CHESNAVFACENGCOM msg 161651Z Jan 80 are selected based on DM-26, July 1968, Change 1. Each component is sized to meet the functional requirements of the mooring and to fit the dimensional requirements for the interfacing of components. Manufacturers have changed dimensions of some mooring components from those of DM-26, FSN listings. Each component of the mooring must be checked for interface dimensional compatibility when recently manufactured commercial and "or equal" components are used. Ref enclosures (2a) and 2(b).

2. Non-Destructive Testing - The NDT can be visual, ultrasonic, or magnetic particle testings whichever is sufficient to assure the required quality and to confirm structural integrity. Inspection results shall be recorded for specific components stating general observed conditions, measurements, and any photo documentation that is performed. It is requested that copies of results be forwarded to CHESDIV Code FPO-1. The NDT requirements are specified as follows:

A. Buoys: Visual inspection for structural integrity. Ultrasonic testing for plate thickness at suspect weak spots. Magnetic partical testing of welds for cracks. Refinish as required.

B. New chains and connecting hardware (shackles, swivels, joining links, anchor joining links, ground rings, spiders)

1. New items with manufacturers quality control certification indicating conformance to Navy specifications require no NDT.

2. New items without quality control certification require visual and dimensional verification of conformance to Section 4, NAVFAC DM-26 (enclosure (1)). A 10% sampling rate is acceptable. If any components are rejected from a 10% sample, all of that batch of components shall be inspected or acceptability.

C. Used Chains and Connecting Hardware:

All used components that show more corrosion than light rusting shall be untrasonically, or magnetic particle inspected to assure structural integrity.

1. Chains and connectors require visual inspection on all items and a 10% sampling rate on dimensional measurement of wire diameter and linkage size. Items with a wire diameter reduced to 0.90 or less of its DM-26 nominal diameter shall be rejected. A 2% or greater elongation in linkage length shall be cause for rejection. Chain and components which show abrasive wear, cuts, nicks, or gauges that are stress risers shall be rejected, replaced, or refurbished by an approved repair process.

2. All swivels shall be checked for free movement. Those that do not rotate freely shall be rejected.

Section 4.

CHAIN AND FITTING DETAILS

TABLE 7–19
Permissible Tolerances for A-Links, Anchor Joining Links, Joining Links, Shackles, Ground Rings, End Links, and Swivels[1]

Wire diameter of part	Wire diameter, plus or minus	Width, plus or minus	Length,[2] plus or minus
3/4 to 1-1/8	1/64	3/64	1/16
1-3/16 to 1-3/8	1/32	5/64	7/64
1-7/16 to 1-5/8	1/32	3/32	1/8
1-11/16 to 1-7/8	1/32	7/64	9/64
1-15/16 to 2-1/8	3/64	1/8	5/32
2-3/16 to 2-3/8	3/64	9/64	11/64
2-7/16 to 2-7/8	3/64	5/32	3/16
2-15/16 to 3-3/8	1/16	11/64	13/64
3-7/16 to 3-7/8	1/16	3/16	7/32
4 to 4-3/8	1/16	13/64	15/64
4-1/2 to 4-7/8	1/16	7/32	1/4
5 to 5-3/8	5/64	15/64	17/64
5-1/2 to 5-7/8	5/64	1/4	9/32
6 to 6-5/8	5/64	1/4	9/32

[1]See notes below. All dimensions in inches.

[2]Also outside diameter of ground rings.

Tolerances, Markings, and General Notes

Tolerances (applicable to table 7–19):

Tolerance of spider wire diameter at each end + 1/16 in.

For permissible tolerance of length and width of anchor joining links (SET), anchor joining links, and end links, use wire diameter D.

Tolerance of dimension F for anchor joining links (SET) and anchor joining links shall be ± 1/8 in. Tolerance for other dimensions are according to the table, providing they do not increase the tolerance of dimension F.

The overall length of six A-links, measuring from every third link, shall not exceed 3/8 in. more or 1/8 in. less per inch of wire diameter than the normal length.

Wire diameters shall be taken as half the sum of two measurements at right angles to each other.

Markings:

Studs of alternative A-links, joining links, anchor joining links (SET), anchor joining links, and sides of shackles and swivels shall be marked on one side with manufacturer's initials or trademark, size of chain, and letters YD.

Screw shackles, ground rings, spider, and F-shackles with lugs shall be marked on one side with manufacturer's initials or trademark and on the opposite side with the stock number.

End links shall be marked on one side with manufacturer's initials or trademark and largest corresponding chain size, and on the opposite side with the stock number.

See telephone buoy swivel and rubbing casting details for location of their markings.

All markings shall be raised letters of figures of size permitted by the space available but not to exceed 3/4 in. in height by 1/8 in. in relief. The space selected for markings shall be points that carry a minimum of stress and have a minimum of wear.

General Notes:

All joining links and the small end of anchor joining links shall have a trial joining with their designated A-links, using A-links of minimum width and length and maximum wire diameter.

Manufacturer's details of chain and fittings shall be subject to the approval of the Naval Facilities Engineering Command Headquarters.

All items are to be subject to proof and break test loads as noted.

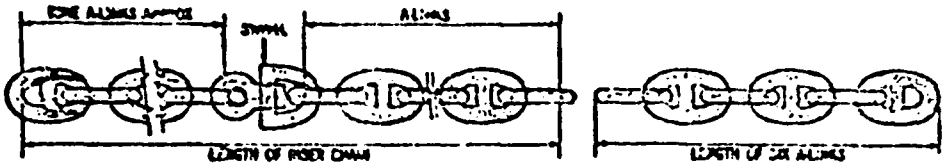
All chain and appendages to be cast, welded, or forged steel of size indicated.

SET means small end type.

All chain and fittings contained in section 1, as follows, shall conform to MIL-C-18295 docks titled "Chain and Fittings for Fleet Moorings, High Strength."

TABLE 7–20

Chain and Fitting Details, Common A-Link Chain and Riser Chains[1]



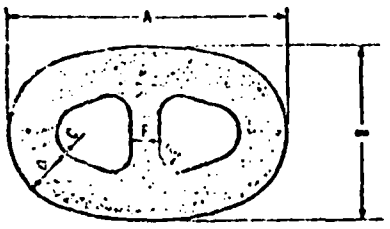
Chain size (in.)	Proof test (lb)	Break test (lb)	Stock No., one A-link	Federal Stock No. 90 ft shot	Federal Stock No. 45 ft shot	Riser chains	
						Federal Stock No.	Length (ft)
4	840,000	1,176,000	411,600	4010-270-1641	4010-270-1646	2050-227-0525	40±
3-1/2	658,440	921,810	322,633	4010-262-2584	4010-262-2588	2050-227-0523	40±
3	495,000	693,000	242,550	4010-240-1036	4010-240-1041	2050-227-0530	40±
2-3/4	420,660	588,930	206,175	4010-240-1035	4010-240-1040	2050-227-0502	40±
2-1/2	351,560	492,190	172,266	4010-240-1034	4010-240-1039	2050-227-0529	35±
2-1/4	287,930	403,100	141,085	4010-240-1030	4010-240-1038	2050-227-0504	30±
2	230,060	322,000	112,700	4010-262-2592	4010-262-2593	2050-227-0503	25±
1-3/4	178,000	249,210	87223	4010-262-2585	4010-262-2589	2050-227-0501	25±
1-1/2	132,190	185,060	64771	4010-240-1033	4010-240-1031	.....	.....
1-1/4	92,910	130,070	45524	4010-240-1032	4010-240-1037	2050-262-9179	20±
1	60,360	84,500	29575	4010-262-2586	4010-262-2590	.....	.....
3/4	34,680	48,560	12138	4010-262-2587	4010-262-2591	2050-227-0524	15±

[1]For permissible tolerances, marking, and general notes, see table 7–19.
All Federal Stock Nos. to have prefix 2C.

MAX WORKING LOAD 0.35%
PAR 7(b), PG 26-6-46

TABLE 7–21

Chain and Fitting Details, Common A-Link Chains[1]

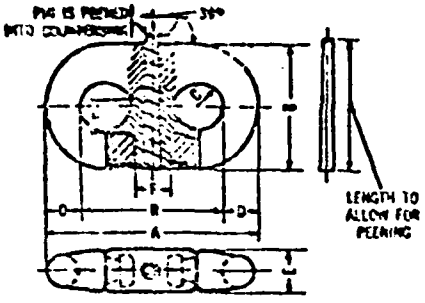


Chain size	A	B	C	D	E	F	Length, six A-links
4	24	14-3/8	2-5/16	4	2	2-3/4	104
3-1/2	21	12-5/8	2-1/16	3-1/2	1-3/4	2-3/8	91
3	18	10-13/16	1-13/16	3	1-1/2	2-1/16	78
2-3/4	16-1/2	9-7/8	1-5/8	2-3/4	1-3/8	1-7/8	71-1/2
2-1/2	15	9	1-1/2	2-1/2	1-1/4	1-11/16	65
2-1/4	13-1/2	8-1/8	1-3/8	2-1/4	1-1/8	1-1/2	58-1/2
2	12	7-3/16	1-1/4	2	1	1-3/8	52
1-3/4	10-1/2	6-5/16	1-1/16	1-3/4	7/8	1-3/16	45-1/2
1-1/2	9	5-3/8	15/16	1-1/2	3/4	1	39
1-1/4	7-1/2	4-1/2	25/32	1-1/4	5/8	7/8	32-1/2
1	6	3-9/16	21/32	1	1/2	11/16	26
3/4	4-1/2	2-5/8	1/2	3/4	3/8	1/2	19-1/2

[1]For permissible tolerances, marking, and general notes, see table 7–19.
All dimensions in inches.

TABLE 7–22

Chain and Fitting Details, Joining Links[1]
(Baldt Anchor, Chain, and Forge Company)



Chain size	Federal Stock No.[2] 4010-	Dimensions[3]						
		A	B	C	D	E	F	R
4	202-2715	24	15-11/16	2-5/8	4	5-3/8	4-5/8	16
3-1/2	599-8927	21	14-5/32	2-1/8	3-1/2	4-5/8	4-1/4	14
3	391-0545	18	11-29/32	1-13/16	3	4	3-13/32	12
2-3/4	391-0544	16-1/2	10-9/16	1-23/32	2-3/4	3-21/32	3-11/32	11
2-1/2	391-0543	15	9-3/4	1-21/32	2-1/2	3-3/8	2-7/8	10
2-1/4	391-0542	13-1/2	8-25/32	1-1/2	2-1/4	3-1/8	2-5/8	9
2	391-0541	12	7-27/32	1-5/16	2	2-11/16	2-5/16	8
1-3/4	202-2708	10-1/2	6-51/64	1-5/32	1-3/4	2-5/16	2-1/32	7
1-1/2	391-0540	9	5-7/8	1	1-1/2	2	1-3/4	6
1-1/4	391-0539	7-1/2	4-29/32	27/32	1-1/4	1-11/16	1-7/16	5
1	245-0466	6	3-59/64	21/32	1	1-11/32	1-5/32	4
3/4	141-4978	4-1/2	2-15/16	1/2	3/4	1-1/32	7/8	3

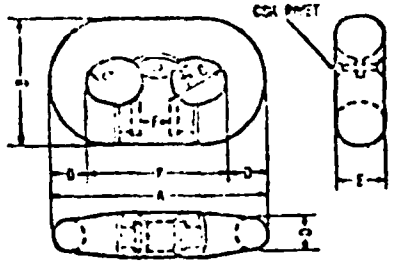
[1]For permissible tolerances, marking, and general notes, see table 7–19.
Proof and break test of joining links for indicated chain sizes are the same as for chain sizes shown on table 7–20.

[2]All Federal Stock Nos. to have prefix 2C.

[3]All dimensions in inches.

TABLE 7-23

Chain and Fitting Details, Joining Links[1]
(National Malleable and Steel Castings Company)



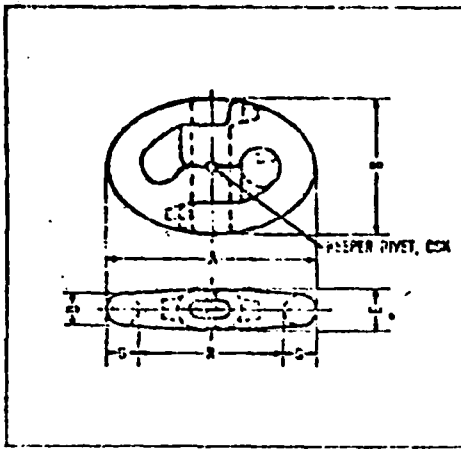
Chain size	Federal Stock No.[2] 4010-	Dimensions[3]						
		A	B	C	D	E	F	R
4	202-2715	.....	.....	.....	.....	.....	.....	.....
3-1/2	599-8927	.....	.....	.....	.....	.....	.....	.....
3	391-0545	18-3/8	11-3/8	1-21/32	3-3/16	3-11/16	3-3/16	12
2-3/4	391-0544	16-7/8	10-3/8	1-1/2	2-15/16	3-7/16	2-7/8	11
2-1/2	391-0543	15-1/4	9-7/16	1-3/8	2-5/8	3-1/8	2-5/8	10
2-1/4	391-0542	13-3/4	8-1/2	1-1/4	2-3/8	2-7/8	2-3/8	9
2	391-0541	12-1/4	7-9/16	1-1/8	2-1/8	2-5/8	2-1/8	8
1-3/4	202-2708	.....	.....	.....	.....	.....	.....	.....
1-1/2	391-0540	9-1/8	5-11/16	13/16	1-9/16	1-15/16	1-5/8	6
1-1/4	391-0539	7-5/8	4-3/4	11/16	1-5/16	1-11/16	1-3/8	5
1	245-0466	.....	.....	.....	.....	.....	.....	.....
3/4	.....	.....	.....	.....	.....	.....	.....	.....

[1]For permissible tollerances, marking, and general notes, see table 7–19.
Proof and break test of joining links for indicated chain sizes are the same as for chain sizes shown on table 7–20.

[2]All Federal Stock Nos. to have prefix 2C.

[3]All dimensions in inches.

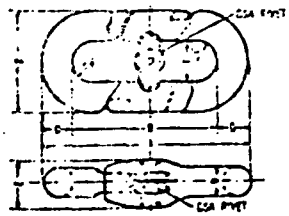
TABLE 7-24
Chain and Fitting Details, Joining Links[1]
(Portland Chain Manufacturing Company)



Chain size	Federal Stock No.[2] 4010-	Dimensions[3] A	B	C	D	E	G	R
4	202-2715	24-1/2	15-3/16	2-1/4	4	4-5/8	5-1/4	16
3-1/2	599-8927	21-1/2	13-1/4	1-15/16	3-1/2	4	3-3/4	14
3	391-0545	18-3/8	11-3/8	1-11/16	3	3-7/16	3-3/16	12
2-3/4	391-0544	16-7/8	10-3/8	1-17/32	2-3/4	3-3/16	2-15/16	11
2-1/2	391-0543	15-1/4	9-1/2	1-13/32	2-1/2	2-7/8	2-5/8	10
2-1/4	391-0542	13-3/4	8-1/2	1-1/4	2-1/4	2-5/8	2-3/8	9
2	391-0541	12-1/4	7-5/8	1-1/8	2	2-3/8	2-1/8	8
1-3/4	202-2708	10-3/4	6-5/8	31/32	1-3/4	2-1/16	1-7/8	7
1-1/2	391-0540	9-1/8	5-3/4	27/32	1-1/2	1-3/4	1-9/16	6
1-1/4	391-0539	7-5/8	4-3/4	11/16	1-1/4	1-1/2	1-5/16	5
1	245-0466	6-1/8	3-3/4	19/32	1	1-1/4	1-1/16	4
3/4	141-4978	4-5/8	2-7/8	7/16	3/4	15/16	13/16	3

[1]For permissible tolerances, marking, and general notes, see table 7-19.
Proof and break test of joining links for indicated chain sizes are the same as for chain sizes shown on table 7-20.
[2]All Federal Stock Nos. to have prefix 2C.
[3]All dimensions in inches.

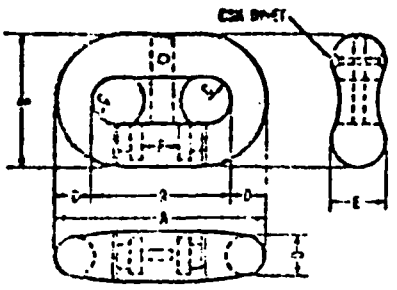
TABLE 7-25
Chain and Fitting Details, Joining Links[1]
(Interstate Drop Forge Company)



Chain size	Federal Stock No.[2] 4010-	Substitute Stock No.	Dimensions[3] A	B	C	D	E	F	R
4	202-2715	.....	24-1/2	15-3/4	2-3/8	4-1/4	7	4-3/4	16
3-1/2	599-8927	.....	21-1/2	14	2-1/4	3-3/4	5-1/2	4-1/2	14
3	391-0545	.....	16-1/2	10-1/4	1-13/16	2-3/4	4-7/16	3-5/8	11
2-3/4	391-0544	.....							
2-1/2	391-0543	.....							
2-1/4	391-0542	.....	12-1/2	7-5/8	1-5/16	2-1/4	3-3/8	2-5/8	8
2	391-0541	.....							
1-3/4	202-2708	.....	9-1/4	5-7/8	1-1/4	1-1/2	2-1/2	2-1/2	6-1/4
1-1/2	391-0540								
1-1/4	391-0539	.....	6-1/8	4	21/32	1-1/16	1-13/16	1-5/16	4
1	245-0466								
3/4	141-4978	.....	4-3/4	3-1/16	15/32	13/16	1-19/32	15/16	3-1/8

[1]For permissible tolerances, marking, and general notes, see table 7-19.
Proof and break test of joining links for indicated chain sizes are the same as for chain sizes shown on table 7-20.
[2]All Federal Stock Nos. to have prefix 2C.
[3]All dimensions in inches.

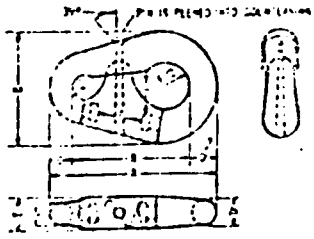
TABLE 7–26
Chain and Fitting Details, Joining Links[1]
(E. V. Camp Steel Works)



Chain size	Federal Stock No.[2] 4010-	Dimensions[3] A	B	C	D	E	F	R
4	.....	.....	.....	.....	.....	.....	.....	..
3-1/2	.....	.....	.....	.....	.....	.....	.....	..
3	391-0545	18	11-5/8	1-31/32	3	4-1/2	3-7/16	12
2-3/4	391-0544	16-1/2	10-5/8	1-13/16	2-3/4	4-1/8	3-3/16	11
2-1/2	391-0543	15	9-11/16	1-21/32	2-1/2	3-3/4	2-7/8	10
2-1/4	391-0542	13-1/2	8-11/16	1-15/32	2-1/4	3-3/8	2-5/8	9
2	391-0541	12	7-3/4	1-5/16	2	3	2-5/16	8
1-3/4	.....	.....	.....	.....	.....	.....	.....	..
1-1/2	391-0540	9	5-13/16	31/32	1-1/2	2-5/16	1-3/4	6
1-1/4	391-0539	7-1/2	4-7/8	13/16	1-1/4	1-15/16	1-7/16	5
1	.....	.....	.....	.....	.....	.....	.....	..
3/4	.....	.....	.....	.....	.....	.....	.....	..

[1]For permissible tolerances, marking, and general notes, see table 7–19.
Proof and break test of joining links for indicated chain sizes are the same as for chain sizes shown on table 7–20.
[2]All Federal Stock Nos. to have prefix 2C.
[3]All dimensions in inches.

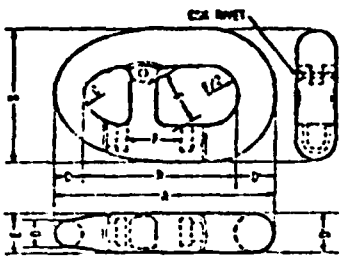
TABLE 7–27
Chain and Fitting Details, Anchor Joining Links[1]
(Baldt Anchor, Chain, and Forge Company)



Chain size	Federal Stock No.[2] 4010-	Dimensions[3] A	B	C	D	D'	E	F	R
4	141-4599	28-3/4	17-1/8	2-1/4	4	5-1/8	5-3/4	7-1/2	19-5/8
3-1/2	329-8928	25-5/8	16	2-1/8	3-5/8	4-7/8	5-1/2	7	17-1/8
3	391-0537	22	14-13/16	1-13/16	3	3-3/4	4-5/8	6-1/2	15-1/4
2-3/4	391-0536	22	14-13/16	1-13/16	3	3-3/4	4-5/8	6	15-1/4
2-1/2	391-0535	22	14-13/16	1-13/16	3	3-3/4	4-5/8	5-1/2	15-1/4
2-1/4	391-0534	17-7/8	12-5/16	1-3/8	2-3/8	3	3-5/8	5	12-1/2
2	391-0533	17-7/8	12-5/16	1-3/8	2-3/8	3	3-5/8	4-1/2	12-1/2
1-3/4	202-4703	15	9-7/8	1-3/16	2	2-1/2	3	4-1/8	10-1/2
1-1/2	391-0532	15	9-7/8	1-3/16	2	2-1/2	3	3-3/4	10-1/2
1-1/4	391-0531	11-3/4	8-1/8	15/16	1-9/16	1-7/8	2-5/16	3-1/4	8-5/16
1	202-3546	9-3/8	6-9/16	3/4	1-3/16	1-1/2	1-13/16	2-3/4	6-7/8
3/4	202-3042	7-5/8	5-3/16	21/32	15/16	1-1/4	1-9/16	2-1/4	5-7/16

[1]For permissible tolerances, marking, and general notes, see table 7–19.
Proof and break test of anchor joining links for indicated chain sizes are the same as for chain sizes shown on table 7–20.
[2]All Federal Stock Nos. to have prefix 2C.
[3]All dimensions in inches.

TABLE 7–28
Chain and Fitting Details, Anchor Joining Links[1]
(National Malleable and Steel Castings Company)



Chain size	Federal Stock No.[2] 4010-	Dimensions[3] A	B	C	D	D'	E	F	R
4	.....	.....	.....	.....	.....	.....	.....	.....	.....
3-1/2	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	391-0537	24-15/16	14-7/8	1-21/32	3-1/4	4-3/16	4-3/16	6-1/2	17-1/2
2-3/4	391-0536	22-7/8	13-3/4	1-17/32	3	3-7/8	3-7/8	6	16
2-1/2	391-0535	20-13/16	12-5/8	1-13/32	2-3/4	3-9/16	3-9/16	5-1/2	14-1/2
2-1/4	391-0534	18-13/16	11-5/8	1-1/4	2-1/2	3-5/16	3-5/16	5	13
2	391-0533	16-7/8	10-3/4	1-1/8	2-1/4	3-1/8	3-1/8	4-1/2	11-1/2
1-3/4	.....	.....	.....	.....	.....	.....	.....	.....	.....
1-1/2	.....	.....	.....	.....	.....	.....	.....	.....	.....
1-1/4	.....	.....	.....	.....	.....	.....	.....	.....	.....
1	.....	.....	.....	.....	.....	.....	.....	.....	.....
3/4	.....	.....	.....	.....	.....	.....	.....	.....	.....

[1]For permissible tolerances, marking, and general notes, see table 7–19.
Proof and break test of anchor joining links for indicated chain sizes are the same as for chain sizes shown on table 7–20.

[2]All Federal Stock Nos. to have prefix 2C.

[3]All dimensions in inches.

TABLE 7–29
Chain and Fitting Details, Anchor Joining Links[1]
(Portland Chain Manufacturing Company)

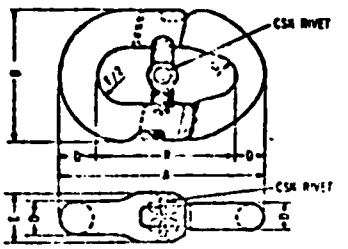
Chain size	Federal Stock No.[2] 4010-	Dimensions[3] A	B	C	D	D'	E	F	G	R
4	141-4[illegible]	31-3/16	20	2-3/16	4-3/16	4-7/8	5-1/2	7-1/2	4-7/16	21-7/8
3-1/2	599-8923	29-7/16	18-5/8	2-1/16	3-7/8	4-7/16	5	7	4-1/8	20-7/8
3	391-0537	23	14-7/8	1-11/16	3	3-9/16	4-1/4	6-1/2	3-1/4	16-3/16
2-3/4	391-0536	21-3/8	13-3/4	1-9/16	2-3/4	3-3/8	3-3/4	6	3	15
2-1/2	391-0535	19-7/16	12-3/4	1-7/16	2-1/2	3	3-3/8	5-1/2	2-3/4	13-11/16
2-1/4	391-0534	17-15/16	11-11/16	1-5/16	2-5/16	2-13/16	3-1/8	5	2-9/16	12-9/16
2	391-0533	16	10-3/8	1-3/16	2-1/16	2-1/2	2-3/4	4-1/2	2-1/4	11-1/4
1-3/4	202-4703	14-3/32	9	1	1-13/16	2-3/16	2-7/16	4-1/8	2	9-29/32
1-1/2	391-0532	12-5/16	8-1/8	15/16	1-9/16	1-7/8	2-1/8	3-3/4	1-11/16	8-3/4
1-1/4	391-0531	10-1/16	6-3/4	11/16	1-3/16	1-7/16	1-3/4	3-1/4	1-5/16	7-5/16
1	202-3546	8-1/16	5-1/4	9/16	1-1/16	1-1/4	1-3/8	2-3/4	1-1/8	5-11/16
3/4	202-3042	6-3/8	4-1/8	7/16	13/16	1	1-5/32	2-1/4	7/8	4-1/2

[1]For permissible tolerances, marking, and general notes, see table 7–19.
Proof and break test of anchor joining links for indicated chain sizes are the same as for chain sizes shown on table 7–20.

[2]All Federal Stock Nos. to have prefix 2C.

[3]All dimensions in inches.

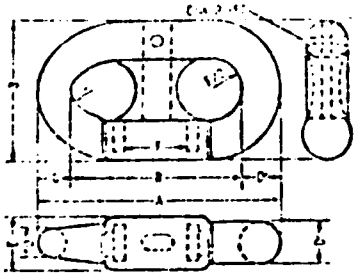
TABLE 7–30
Chain and Fitting Details, Anchor Joining Links[1]
(Interstate Drop Forge Company)



Chain size	Federal Stock No.[2] 4010-	Dimensions[3] A	B	C	D	D'	E	F	R
4	141-4899	31-1/2	18-1/2	2-1/2	4	5-1/2	7	7-1/2	22
3-1/2	599-8928	27-1/4	16-1/2	2	3-1/2	4-3/4	5-9/16	7	19
3	391-0537	24-1/4	15-1/8	1-7/8	3-1/4	4-5/16	5-9/16	6-1/2	16-11/16
2-3/4	391-0536	20-7/8	13-1/2	2	3	3-5/8	5	6	14-1/4
2-1/2	391-0535	20-3/8	13-1/4	2	3	3-1/2	5	5-3/4	13-7/8
2-1/4	391-0534	16	10-1/4	1-7/8	2-3/8	2-7/8	4	5	10-3/4
2	391-0533	15	9-7/8	1-7/8	2-1/4	2-3/4	3-3/4	4-5/8	10
1-3/4	202-4703	14-1/8	8-5/8	1-1/16	1-7/8	2-3/8	3-1/4	4-1/8	9-7/8
1-1/2	391-0532	12-3/4	7	7/8	1-5/3	2	2-5/8	3-3/4	9-1/2
1-1/4	391-0531	12	6-3/4	3/4	1-3/8	1-3/4	2-3/8	3-1/4	8-7/8
1	202-3546	10-1/2	5-7/16	3/4	1-1/8	1-3/8	1-13/16	2-3/4	8
3/4	202-3042	8-3/8	4-1/2	5/8	7/8	1-1/4	1-5/8	2-1/4	6-1/4

[1]For permissible tolerances, marking, and general notes, see table 7–19.
Proof and break test of anchor joining links for indicated chain sizes are the same as for chain sizes shown on table 7–20.
[2]All Federal Stock Nos. to have prefix 2C.
[3]All dimensions in inches.

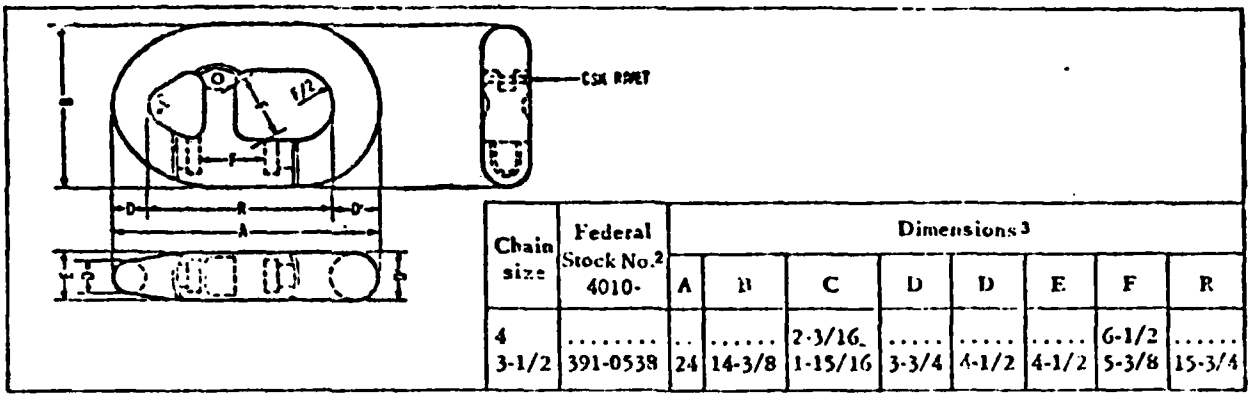
TABLE 7–31
Chain and Fitting Details, Anchor Joining Links[1]
(C. V. Camp Steel Works)



Chain size	Federal Stock No.[2] 4010-	Dimensions[3] A	B	C	D	D'	E	F	R
4	.....	.....	.....	.....	.....	.....	.....	.....	.....
3-1/2	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	391-0537	24-1/4	14-11/16	1-3/4	3-1/4	3-3/4	5-3/8	6-1/2	17-1/4
2-3/4	391-0536	22-1/2	13-9/16	1-5/8	3	3-1/2	4-15/16	6	16
2-1/2	391-0535	20-3/4	12-7/16	1-1/2	2-3/4	3-1/4	4-1/2	5-1/2	14-3/4
2-1/4	391-0534	19	11-5/16	1-3/8	2-1/2	3	4-1/16	5	13-1/2
2	391-0533	17-1/4	10-3/16	1-1/4	2-1/4	2-3/4	3-5/8	4-1/2	12-1/4
1-3/4	.....	.....	.....	.....	.....	.....	.....	.....	.....
1-1/2	391-0532	13-5/8	8	1	1-5/8	2	2-11/16	3-3/4	10
1-1/4	391-0531	11-7/8	6-7/8	13/16	1-3/8	1-3/4	2-1/4	3-1/4	8-3/4
1	.....	.....	.....	.....	.....	.....	.....	.....	.....
3/4	.....	.....	.....	.....	.....	.....	.....	.....	.....

[1]For permissible tolerances, marking, and general notes, see table 7–19.
Proof and break test of anchor joining links for indicated chain sizes are the same as for chain sizes on table 7–20.
[2]All Federal Stock Nos. to have prefix 2C.
[3]All dimensions in inches.

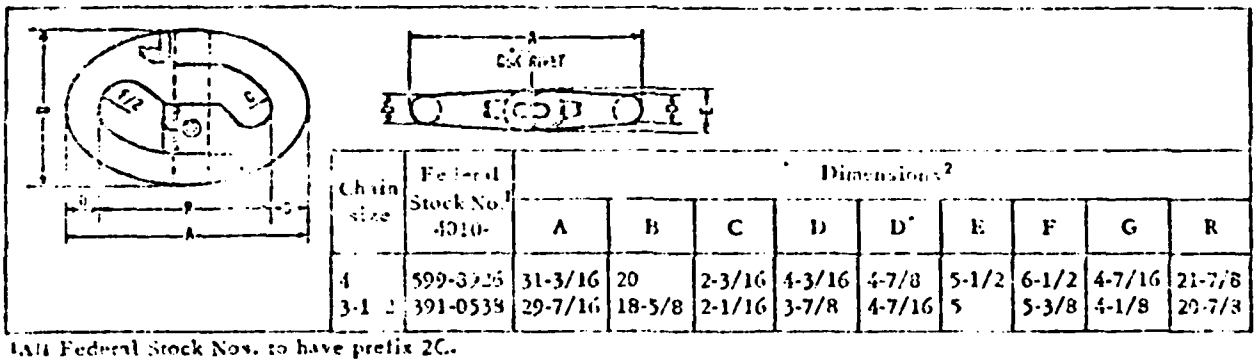
TABLE 7–32
Chain and Fitting Details, Anchor Joining Links, SET[1]
(National Malleable and Steel Castings Company)



Chain size	Federal Stock No.[2] 4010-	Dimensions[3]							
		A	B	C	D	D'	E	F	R
4	.....	..	.....	2-3/16	.....	.....	.....	6-1/2	.....
3-1/2	391-0538	24	14-3/8	1-15/16	3-3/4	4-1/2	4-1/2	5-3/8	15-3/4

[1]For permissible tolerances, marking, and general notes, see table 7–19.
Proof and break test of anchor joining links (SET) for indicated chain sizes are the same as for chain sizes shown on table 7–20.
[2]All Federal Stock Nos. to have prefix 2C.
[3]All dimensions in inches.

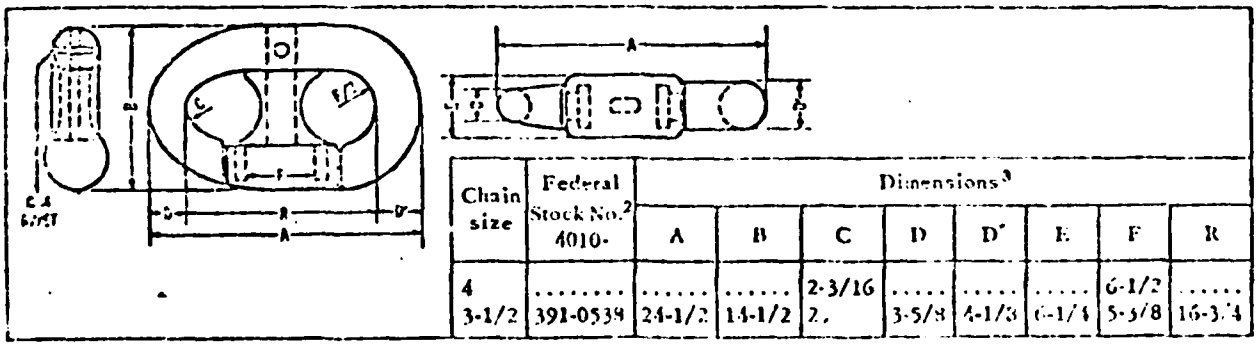
TABLE 7–33
Chain and Fitting Details, Anchor Joining Links, SET
(Portland Chain Manufacturing Company)



Chain size	Federal Stock No.[1] 4010-	Dimensions[2]								
		A	B	C	D	D'	E	F	G	R
4	599-3926	31-3/16	20	2-3/16	4-3/16	4-7/8	5-1/2	6-1/2	4-7/16	21-7/8
3-1/2	391-0539	29-7/16	18-5/8	2-1/16	3-7/8	4-7/16	5	5-3/8	4-1/8	20-7/8

[1]All Federal Stock Nos. to have prefix 2C.
[2]All dimensions in inches.

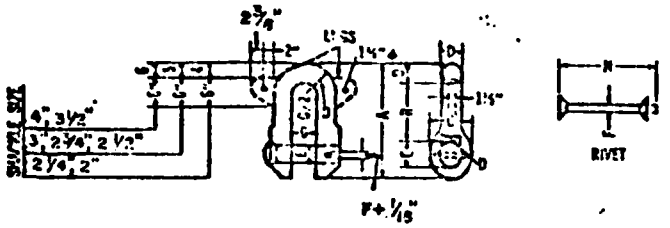
TABLE 7–34
Chain and Fitting Details, Anchor Joining Links, SET[1]
(E. V. Camp Steel Works)



Chain size	Federal Stock No.[2] 4010-	Dimensions[3]							
		A	B	C	D	D'	E	F	R
4	.....	.....	.....	2-3/16	.....	.....	.....	6-1/2	.....
3-1/2	391-0539	24-1/2	14-1/2	2.	3-5/8	4-1/8	6-1/4	5-5/8	16-3/4

[1]For permissible tolerances, marking, and general notes, see table 7–19.
Proof and break test of anchor joining links (SET) for indicated chain sizes are the same as for chain sizes shown on table 7–20.
[2]All Federal Stock Nos. to have prefix 2C.
[3]All dimensions in inches.

TABLE 7–35
Chain and Fitting Details, Type F Bending Shackles[1]



Chain size (in.)	Federal Stock No.[2] 4030- With lugs	Federal Stock No.[2] 4030- Without lugs	A (in.)	C (in.)	D (in.)	E (in.)	F (in.)	N (in.)	G (in.)	R (in.)	Proof test (lb)	Break test (lb)
4	640-9621	.....	35-13/16	12-13/16	5-3/8	7-1/4	1-1/4	14-1/2	8	18-13/16	840,000	1,176,000
3-1/2	640-9620	.....	31-3/16	11-5/16	4-15/16	6-1/4	1-1/4	13	7	16-3/8	658,440	921,810
3	236-8393	.....	26-13/16	9-9/16	4-3/16	5-3/8	1-1/8	11-9/16	6	14-1/8	495,000	693,000
2-3/4	236-8392	236-8398	24-5/8	8-7/8	3-7/8	4-15/16	1-1/8	10-3/4	5-1/2	12-15/16	420,660	588,930
2-1/2	236-8391	236-8397	22-3/8	8	3-1/2	4-1/2	1	9-3/4	5	11-3/4	351,560	492,190
2-1/4	236-8390	236-8396	20-1/16	7-1/4	3-1/8	4-1/16	7/8	8-7/8	4-1/2	10-1/2	287,930	403,100
2	236-8389	236-8395	17-15/16	6-7/16	2-13/16	3-5/8	7/8	8	4	9-3/8	230,000	322,000
1-3/4	.....	292-3784	15-5/8	5-11/16	2-7/16	3-1/8	3/4	7-1/8	3-1/2	8-3/16	178,090	249,210
1-1/2	.....	527-8474	13-1/2	4-7/8	2-1/8	2-11/16	5/8	6-1/8	3	7-1/16	132,190	185,060
1-1/4	.....	292-3783	11-1/4	4	1-3/4	2-1/4	5/8	5-1/4	2-3/4	5-7/8	92,910	130,070
1	.....	.....	9-15/16	3-5/16	1-7/16	1-13/16	1/2	4-1/2	2	4-9/16	60,360	84,500
3/4	.....	527-8872	8-11/16	2-7/16	1-1/16	1-3/8	3/8	3-1/2	1-1/2	3-1/2	34,680	48,550

[1]For permissible tolerances, marking, and general notes, see table 7–19.

[2]All Federal Stock Nos. to have prefix 2C.

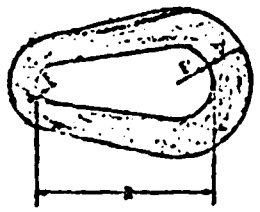
TABLE 7–36
Chain and Fitting Details, Ground Rings[1]

Chain size (in.)	Federal Stock No.[2] 2040-	ID (in.)	W (in.)	Proof test (lb)	Break test (lb)	Chain size (in.)	Federal Stock No. 2040-	ID (in.)	W (in.)	Proof test (lb)	Break test (lb)
4	527-0317	18	6-1/2	840,000	1,176,000	2-1/4	234-4887	14	4-1/2	287,930	403,100
3-1/2	527-0317	18	6-1/2	840,000	1,176,000	2	234-4886	14	4	230,000	322,000
3	234-4890	16	6	495,000	693,000	1-3/4	234-4885	12	3-1/2	178,000	249,210
2-3/4	234-4889	15	5-1/2	420,660	588,930	1-1/4	234-4884	10	2-3/4	92,910	130,070
2-1/2	234-4888	14	4-3/4	351,560	492,190	3/4	209-7743	10	1-7/8	34,660	48,550

[1]For permissible tolerances, marking, and general notes, see table 7–19.

[2]All Federal Stock Nos. to have prefix 2C.

TABLE 7–37
Chain and Fitting Details, End Links[1]

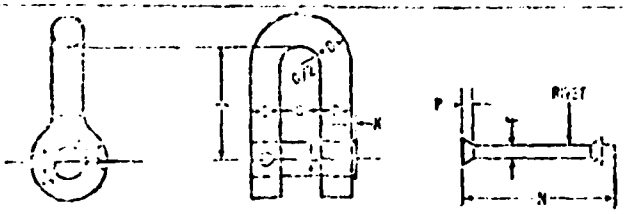


Chain size (in.)	Federal Stock No.[2] 4010-	D (in.)	D′ (in.)	E (in.)	E′ (in.)	R (in.)	Proof test (lb)	Break test (lb)
4	641-0006	4-1/4	5-1/2	2-7/8	5	20	840,000	1,176,000
3-1/2	641-0005	3-15/16	5	2-1/2	4-3/4	18	658,440	921,810
3	274-5024	3-3/4	4-1/2	2-3/16	4-1/2	18	495,000	693,000
2-3/4	274-5023	3-3/8	4-1/8	2	4-1/4	18	420,660	588,930
2-1/2	298-5784	3-1/8	3-3/4	1-7/8	4	15	351,560	492,190
2-1/4	298-6673	2-3/4	3-3/8	1-3/4	3-3/4	15	287,930	403,100
2	274-5022	2-1/2	3	1-1/2	3-1/2	15	230,000	322,000
1-3/4	274-5021	2-1/4	2-3/4	1-3/8	3-1/4	15	178,000	249,000
1-1/4	274-5020	1-3/4	2-1/4	1	2-3/4	12	92,910	130,070
3/4	298-6677	1	1-1/2	5/8	2-1/4	10	34,630	48,550

[1]For permissible tolerances, marking, and general notes, see table 7–19.

[2]All Federal Stock Nos. to have prefix 2C.

TABLE 7–38
Chain and Fitting Details, Sinker Shackles[1]

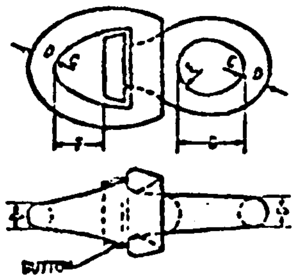


Chain size (in.)	Federal Stock No.[2] 4010-	C/2 (in.)	D (in.)	E (in.)	F (in.)	G/2 (in.)	J (in.)	K (in.)	N (in.)	P (in.)	S (in.)	Proof test (lb)	Break test (lb)
2 to 3	257-7076	2-15/16	2-15/16	2-1/4	5/8	1-5/8	15	7/16	7-1/2	3/8	11/16	150,000	200,000
1-1/2 to 2	298-5782	2-3/16	2	1-3/4	1/2	1-1/8	10-3/4	5/16	5-7/8	1/4	9/16	100,000	135,000
1 to 1-1/2	298-5781	1-1/4	1-1/2	1-1/4	3/8	1	8-1/8	1/4	4	3/16	7/16	49,000	65,000

[1]For permissible tolerances, marking, and general notes, see table 7–19.

[2]All Federal Stock Nos. to have prefix 2C.

TABLE 7–39
Chain and Fitting Details, Swivels[1]

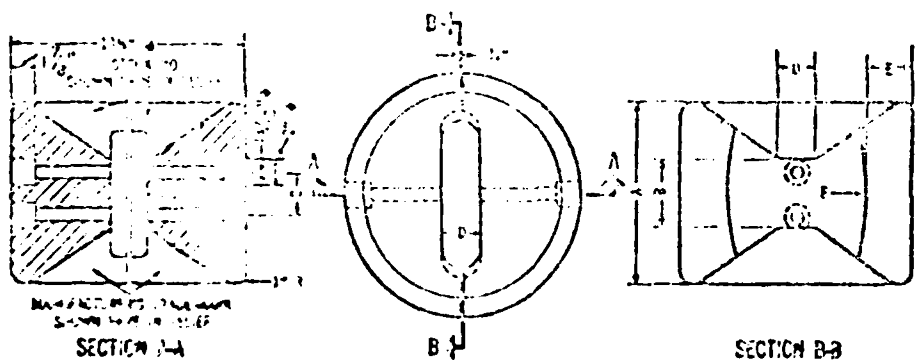


Chain size (in.)	Federal Stock No.[2] 4030-	C (in.)	D (in.)	E (in.)	F (in.)	G (in.)	Proof test (lb)	Break test (lb)
4	527-8866	2-1/2	4-1/8	3-1/2	7	7-1/2	840,000	1,176,000
3-1/2	527-8867	2-1/4	3-5/8	3	6	6-9/16	658,440	921,610
3	527-8868	1-15/16	3-1/8	2-5/8	5-1/4	5-11/16	495,000	693,000
2-3/4	527-8869	1-3/4	2-7/8	2-3/8	4-7/8	5-1/4	420,660	588,930
2-1/2	527-8870	1-9/16	2-5/8	2-1/8	4-1/2	4-13/16	351,560	492,190
2-1/4	527-8864	1-7/16	2-3/8	1-15/16	4	4-3/8	287,930	403,100
2	263-8330	1-5/16	2-1/8	1-3/4	3-1/2	4	230,000	322,[illegible]
1-3/4	527-8865	1-1/8	1-7/8	1-1/2	3-1/16	3-7/16	178,000	249,210
1-1/2	263-9329	1	1-5/8	1-5/16	2-11/16	2-15/16	132,190	185,060
1-1/4	263-9328	7/8	1-5/16	1-1/8	2-5/16	2-7/16	92,910	130,070
1	227-1461	3/4	1-1/8	7/8	1-7/8	2	60,360	84,500
3/4	227-1[illegible]	9/16	7/8	11/16	1-1/2	1-9/16	34,680	48,550

[1] For permissible tolerances, marking, and general notes, see table 7–19.
The buttons shall be cast integrally with male pieces.
Dimensions of swivels shall permit joining with all of their designated joining links.

[2] All Federal Stock Nos. to have prefix 2C.

TABLE 7–40
Chain and Fitting Details, Robbing Casting[1]

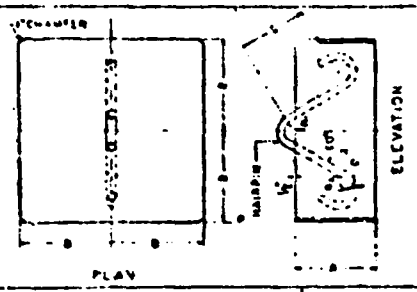


Required per assembly:
Two 3/4" × 16" galv steel bolts and nuts.
65306-174-95[illegible]-bolt
65310-[illegible]-7950-nut
Two 3/4" lock washers electrozinc or cadmium plated,
[illegible]310-013-9[illegible]06.
Material:
Cast steel, MIL-S-15083, class CW.

Chain size	Federal Stock No.[2] 4030-	A	B	C	D	E	F
4	640-9618	16	7	4-1/2		2	25
3-1/2	640-9620	16	5 1/2	4	[illegible]-1/2	2-7/8	22
3	640-9619	14	5-1/4	3-1/2	3	3-3/4	21
2-3/4	292-3780	14	4 7/8	3-1/4	2-3/4	4-1/4	18
2-1/2	292-3781	12	4-1/2	3	2-1/2	4-1/2	16

[1] All dimensions in inches.
[2] All Federal Stock Nos. to have prefix KZ.

TABLE 7-41
Details of Concrete Sinkers



NOTE

Hairpins of the same diameter but of different form and length may be substituted for those given in this table provided that the shape of sinker shown is changed to suit the shape of hairpin without change of the sinker volume.

The above applies also to sinkers used as anchors for navigational buoys except that the sinker plan shall be square.

Concrete sinkers				Quantities of materials required to fabricate sinkers				Hairpins for sinkers					
Weight (lb)[1]	Federal Stock No.[2] 2050-	A	B	Cement (94 lb. bags)	Water gal. (approx)	Fine aggregate (lb)[3]	Coarse aggregate (lb)[3]	Federal Stock No.2 2050-	D	Length	R_1	R_2	C
500	142-0501	1'-6-1/2"	1'-10"	5	30	900	1600	264-4507	1-3/4"	5'-6"	2"	2-1/2"	1'-4-1/2"
800	142-0500	1'-9"	2'-0"	6	40	1200	2100	254-4508	2"	6'-0"	2-1/4"	3"	1'-6"
1000	142-0499	1'-11"	2'-1-1/2"	7	50	1500	2600	264-4508	2"	6'-0"	2 1/4"	3"	1'-6"
2000	142-0503	2'-1"	2'-4"	10	65	2000	3400	270-5778	2-1/4"	7'-0"	2-3/4"	3-1/2"	1'-10"
3000	142-0502	2'-3"	2'-6"	12	80	2600	4400	270-5779	3"	7'-6"	4"	3-1/2"	1'-10-1/2"

[1] Weights given are based on the use of aggregates with a specific gravity of 2.65. In case aggregates of different specific gravity are used, the sinkers shall be modified so that they shall have submerged weights equal to 56% of the weights given in the table.

[2] Federal Stock Nos. to have prefix 2C.

[3] Weights in Air. Submerged weight = 56% of weights in air. Chain lengths given in various tables for chains with sinkers are based on the submerged weights of sinkers shown in this table.

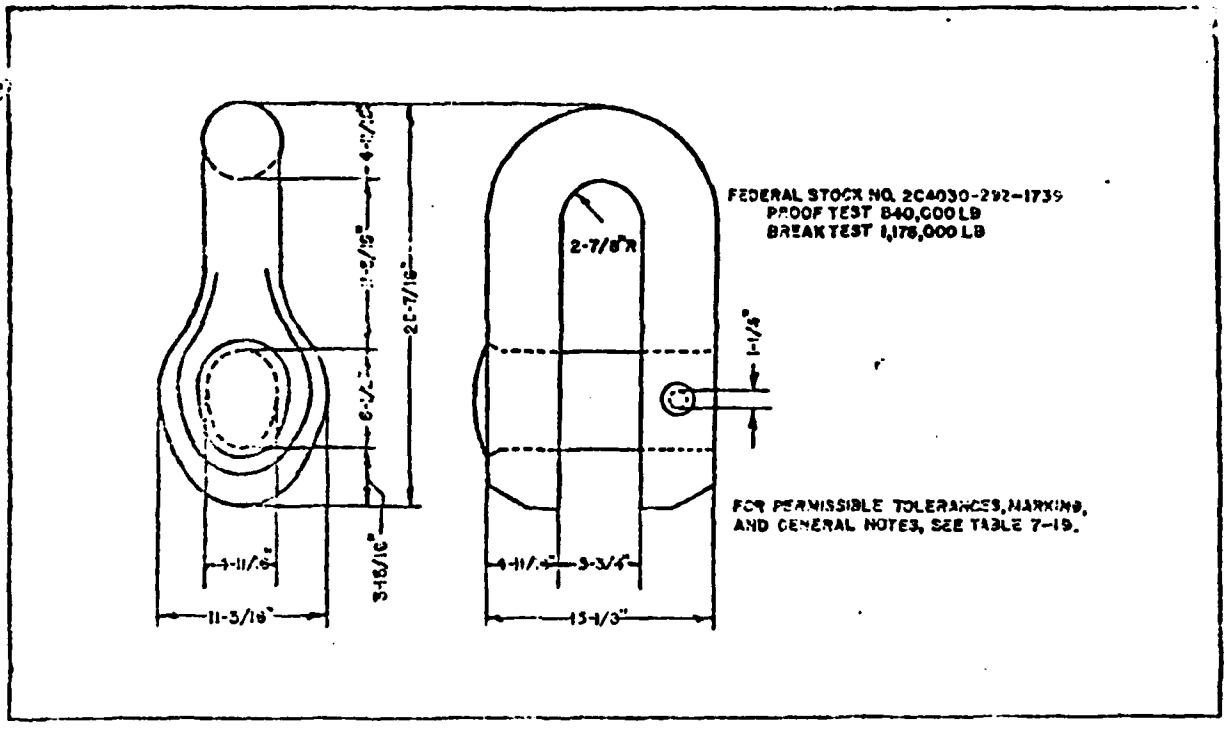


FIGURE 7-7
Chain and Fitting Details, 4-Inch D-Shackle

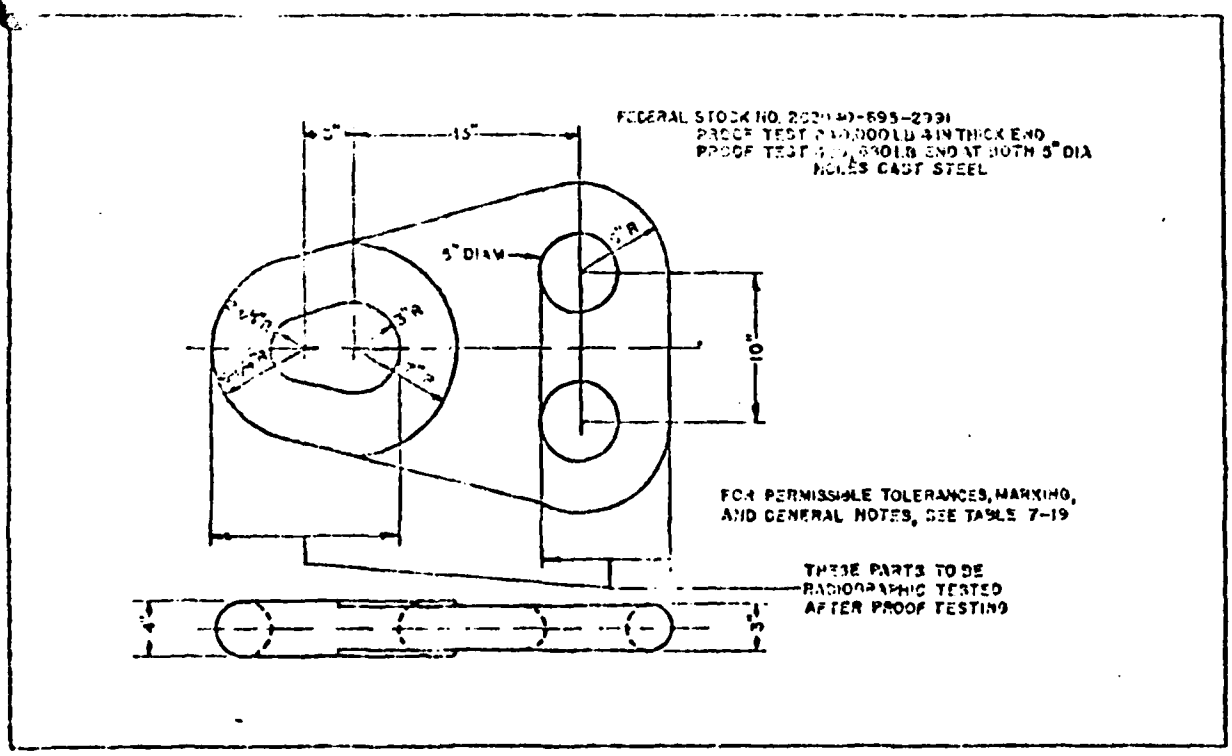


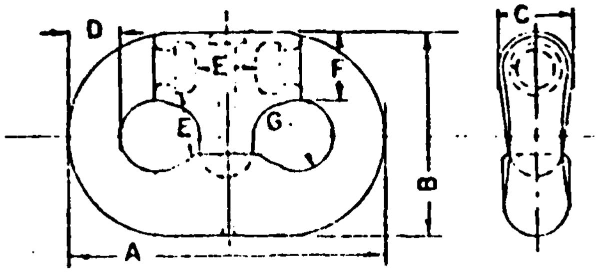
FIGURE 7-8
Chain and Fitting Details, Spider

SECTION 3

chain attachments

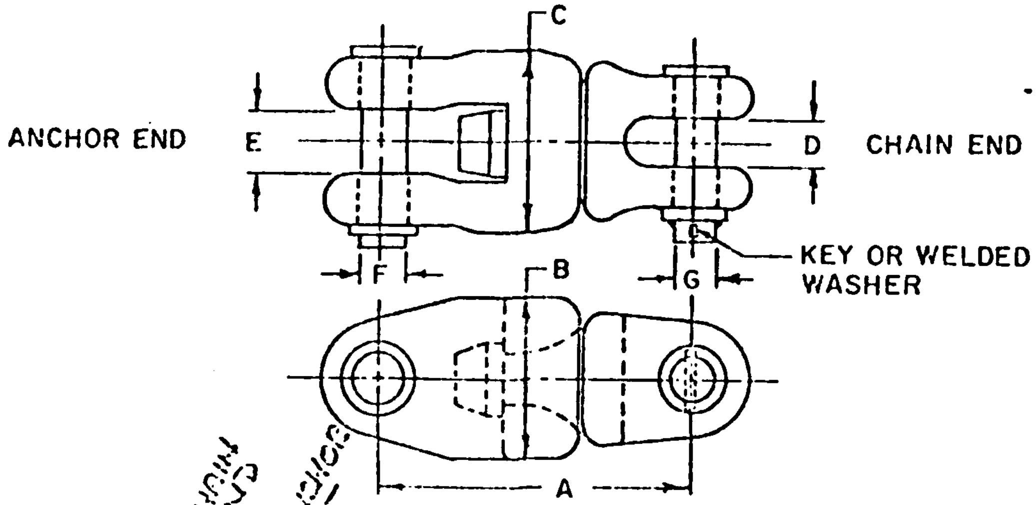
CONTENTS

BALDT DETACHABLE CHAIN CONNECTING LINKS



CHAIN SIZE		A	B	C	D	E	F	G	Proof Test In Pounds	Break Test In Pounds	Wt. Lbs.
INCHES	MM										
¾	19	4½	3	[illegible]	[illegible]	[illegible]	[illegible]	½	67,500	91,100	2.1
[illegible]	21 - 22	5¼	[illegible]	[illegible]	⅞	[illegible]	[illegible]	[illegible]	83,250	115,000	3.4
[illegible] - 1	24 - 25	5	4	[illegible]	1	1⅛	[illegible]	[illegible]	115,100	155,700	5.1
[illegible] - 1⅛	27 - 29	6¾	4½	[illegible]	1⅛	[illegible]	[illegible]	[illegible]	145,000	[illegible]	7.2
[illegible] - 1¼	30 - 32	7½	5	[illegible]	1¼	[illegible]	[illegible]	[illegible]	178,250	210,600	9.3
[illegible] - 1⅜	33 - 34	8¼	5½	[illegible]	1⅜	[illegible]	[illegible]	[illegible]	211,500	255,500	12.3
[illegible] - 1½	36 - 38	9	6	[illegible]	1½	[illegible]	[illegible]	[illegible]	252,000	310,200	17.3
[illegible] - 1⅝	40 - 42	9¾	6½	2¼	1⅝	[illegible]	[illegible]	1¼	[illegible]	[illegible]	22.0
[illegible] - 1¾	43 - 44	[illegible]	7½	[illegible]	1¾	2	[illegible]	[illegible]	352,000	[illegible]	27.5
[illegible] - 1⅞	46 - 48	[illegible]	[illegible]	[illegible]	1⅞	[illegible]	[illegible]	[illegible]	[illegible]	432,000	32
[illegible] - 2	50 - 51	[illegible]	[illegible]	[illegible]	2	[illegible]	2½	[illegible]	[illegible]	493,000	36
[illegible] - 2⅛	52 - 54	[illegible]	[illegible]	[illegible]	2⅛	2½	[illegible]	[illegible]	362,000	548,000	[illegible]
[illegible] - 2¼	56 - 58	13½	[illegible]	[illegible]	2¼	2⅝	[illegible]	1½	[illegible]	610,000	[illegible]
[illegible] - 2⅜	59 - 60	14¼	[illegible]	[illegible]	2⅜	2¾	[illegible]	[illegible]	447,000	675,000	61
[illegible] - 2½	62 - 64	15	[illegible]	3⅛	2½	2⅞	3⅛	[illegible]	492,000	744,000	[illegible]
[illegible] - 2⅝	65 - 67	15¾	[illegible]	[illegible]	2⅝	[illegible]	[illegible]	[illegible]	540,000	813,000	82
[illegible] - 2¾	69 - 70	16½	[illegible]	[illegible]	2¾	3¼	[illegible]	[illegible]	649,000	931,000	[illegible]
[illegible] - 2⅞	71 - 73	17¼	[illegible]	[illegible]	2⅞	[illegible]	[illegible]	[illegible]	640,000*	955,000	[illegible]
[illegible] - 3	75 - 76	18	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	1,015,000	[illegible]
[illegible] - 3⅛	78 - 79	18¾	[illegible]	4	3⅛	[illegible]	[illegible]	[illegible]	748,000	1,123,000	133
[illegible] - 3¼	81 - 83	19½	[illegible]	[illegible]	3¼	[illegible]	[illegible]	[illegible]	[illegible]	1,210,000	[illegible]
[illegible] - 3⅜	84 - 86	[illegible]	[illegible]	[illegible]	3⅜	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	177
[illegible] - 3½	87 - [illegible]	[illegible]	[illegible]	[illegible]	3½	[illegible]	4½	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] - 3⅝	90 - [illegible]	[illegible]	[illegible]	[illegible]	3⅝	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] - 3¾	94 - 95	22½	[illegible]	[illegible]	3¾	[illegible]	[illegible]	[illegible]	1,120,000	[illegible]	[illegible]
[illegible] - 3⅞	97 - 98	[illegible]	[illegible]	5	3⅞	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] - 4	100 - 102	24	15½	[illegible]	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	105	[illegible]	[illegible]	[illegible]	[illegible]	5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	103	25½	[illegible]	[illegible]	[illegible]	[illegible]	5½	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	111	[illegible]	[illegible]	[illegible]	4½	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	114	27	[illegible]	8	[illegible]	6	[illegible]	3	[illegible]	[illegible]	[illegible]

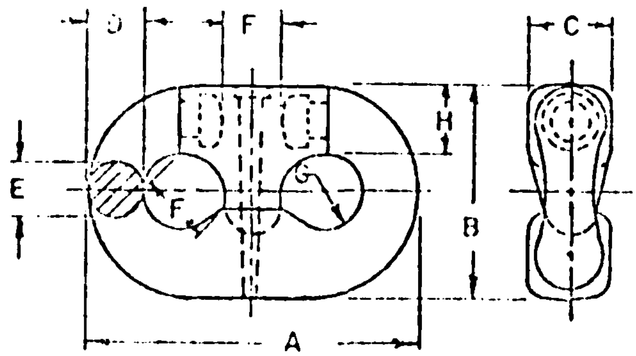
BALDT JAW & JAW SWIVEL SHACKLES



A	B	C	D	E	F	G
29[illegible]	13[illegible]	15	3[illegible]	7[illegible]	4[illegible]	2[illegible]
29[illegible]	13[illegible]	[illegible]	3[illegible]	7[illegible]	4[illegible]	3
[illegible]	18	17	4[illegible]	9	5[illegible]	5[illegible]
3[illegible]	21[illegible]	19	4[illegible]	10	[illegible]	4
3[illegible]	21[illegible]	19	[illegible]	[illegible]	7[illegible]	4

The Jaw & Jaw swivel shackle is designed to accept the shank of an anchor and the chain end is designed to accept a closed spelter socket or mooring chain. The applied proof load is dependent upon applicable design.

BALDT O.R.Q. DETACHABLE CHAIN CONNECTING LINKS®

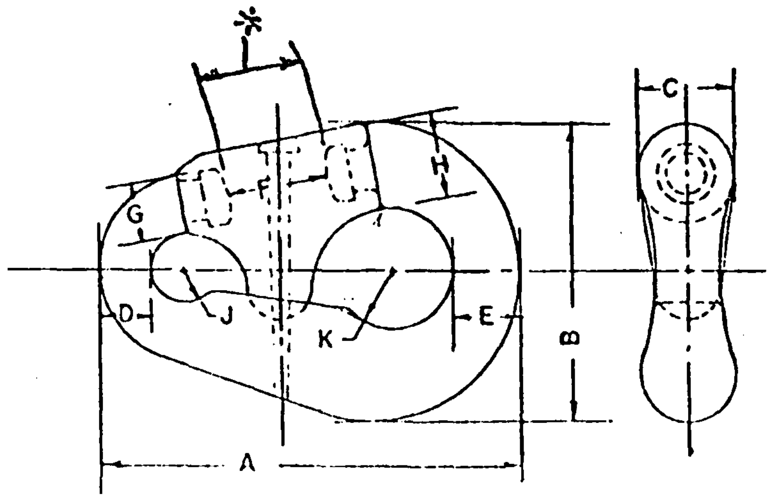


CHAIN SIZE		A	B	C	D	E	F	G	H	PROOF TEST IN POUNDS	BREAK TEST IN POUNDS
INCHES	MM										
3	76	18½	12[illegible]	4[illegible]	3[illegible]	3[illegible]	3[illegible]	1[illegible]	4½	810,[illegible]	1,274,000

* OIL RIG QUALITY

PATENT PENDING

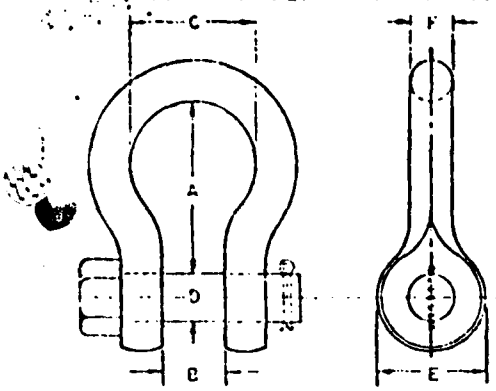
BALDT DETACHABLE ANCHOR CONNECTING LINKS



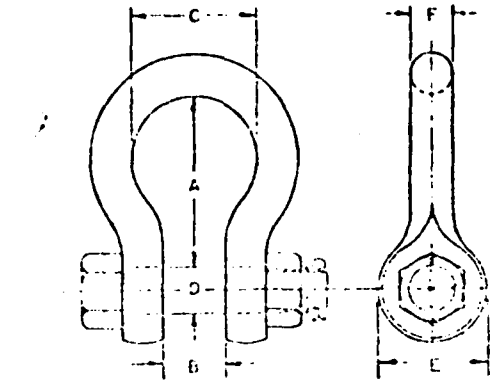
"K" DIM IS LARGER THEN "F"

CHAIN SIZE NO	CHAIN SIZE INCHES	CHAIN SIZE MM	A	B	C	D	E	F	G	H	J	K	PROOF TEST IN POUNDS	BREAK TEST IN POUNDS	WT. LBS.
2	¾ - 15/16	19-24	7¾	5¾	1½	15/16	1¼	2½	15/16	1¾	15/16	1⅝	74,000	113,500	7
3	1 - 1[illegible]	25-30	9[illegible]	6[illegible]	1[illegible]	1⅛	1½	2[illegible]	1⅜	1½	¾	1¾	118,000	179,500	14
4	1¼ - 1[illegible]	32-40	11[illegible]	8¾	2[illegible]	1[illegible]	1¾	3[illegible]	1[illegible] x 1[illegible]	2[illegible]	1[illegible]	1[illegible]	[illegible]	[illegible]	28
5	1⅝ - 2	42-51	1[illegible]	1[illegible]	3	2	2½	3[illegible]	2[illegible] x 2[illegible]	2[illegible]	1[illegible]	2[illegible]	322,000	[illegible]	69
6	2[illegible] - 2[illegible]	52-60	1[illegible]	12[illegible]	3[illegible]	2[illegible]	3	4[illegible]	2[illegible] x 2[illegible]	3[illegible]	1[illegible]	2[illegible]	447,000	675,000	10[illegible]
7	2[illegible] - 3[illegible]	62-79	2[illegible]	1[illegible]	4[illegible]	3[illegible]	3[illegible]	5[illegible]	3[illegible] x 3[illegible]	4[illegible]	1[illegible]	3	742,000	1,128,000	20[illegible]
8	3[illegible] - 3[illegible]	81-92	[illegible]	16[illegible]	5[illegible]	3[illegible]	4[illegible]	5[illegible]	4[illegible] x 4	5[illegible] x 5[illegible]	2[illegible]	3[illegible]	1,0[illegible],000	1,[illegible],000	3[illegible]
9	3[illegible] - 3[illegible]	94-95	27[illegible]	17[illegible]	5[illegible]	3[illegible]	5[illegible]	6[illegible]	4[illegible] x 5[illegible]	5[illegible]	2[illegible]	3[illegible]	1,100,000	1,7[illegible],000	520
10	3[illegible] - 4	97-102	35	22[illegible]	7½	4[illegible]	6½	7½	5[illegible]	7[illegible]	2[illegible]	4[illegible]	1,208,000	1,935,500	650

ALLOY SHACKLES



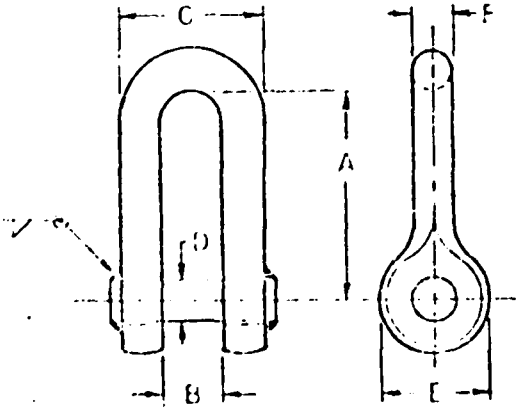
ROUND PIN ANCHOR SHACKLE



SAFETY TYPE ANCHOR SHACKLE

SHACKLE SIZE		A	B	C	D	E	F	WEIGHT LBS. EACH	SAFE WORKING LOAD TONS
INCHES	MM								
1½	38	5¼	2⅜	3⅜	1¼	3¼	1½	20.80	30
1¾	44	7	2⅞	5	2	4⅜	1¾	33.91	40
2	51	7¾	3¼	5¾	2¼	5	2	51.75	50
2½	64	10½	4⅛	7⅛	2¾	6	2½	101.50	80
3	76	13	5	7⅞	3¼	6½	3	178.00	110
3½	89	14⅛	5¼	9½	3¼	8	3½	265.00	140

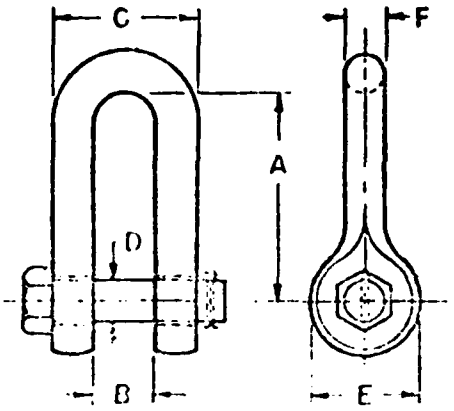
BALDT CHAIN SHACKLE STRAIGHT PIN TYPE



SHACKLE SIZE		A	B	C	D	E	F	WEIGHT LBS.	SAFE WORKING LOAD TONS
INCHES	MM								
1	25	3¼	1⅛	3⅛	1⅛	2⅛	1	6	8.5
1¼	32	4⅛	2⅛	4⅛	1⅜	3	1¼	11	12
1½	38	5⅛	2⅝	5⅛	1⅝	3⅜	1½	19	17
2	51	7	3¼	7¼	2¼	5	2	45	35
2½	64	9⅛	4⅛	9⅛	2¾	6	2½	81	55
3	76	11⅛	5	11	3¼	6½	3	139	85
3½	89	12⅞	5¼	12⅛	3⅝	8	3½	211	120
4	102	19	5¾	13⅛	4	9½	4	339	150
4½	114	22	6¾	15⅛	4½	10¼	4½	470	190

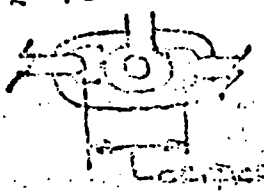
BALDT CHAIN SHACKLE ROUND PIN TYPE

NOT CHAIN SIZE



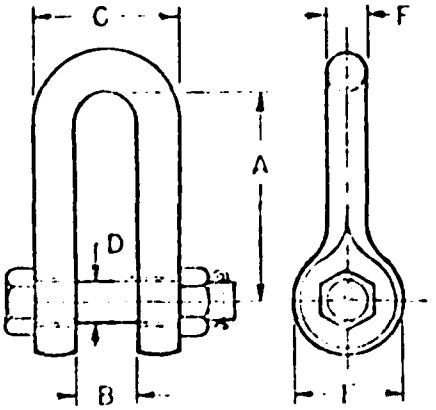
SHACKLE SIZE		A	B	C	D	E	F	WEIGHT LBS	SAFE WORKING LOAD TONS
INCHES	MM								
1	25	3¾	1⅛	3⅛	1⅛	2⅛	1	6	2.5
1¼	32	4⅞	2⅛	4⅛	1⅞	3	1¼	11	12
1½	38	5⅛	2½	5⅛	1⅝	3⅝	1½	19	17
2	51	7⅛	3¼	7⅛	2⅝	5	2	45	35
2½	64	9⅛	4⅛	9⅛	2⅞	6	2½	81	55
3	76	10⅝	5	11	3⅛	6½	3	139	85
3½	89	12⅛	5⅝	12⅝	3⅝	8	3½	241	120
4	102	19	5⅝	13⅝	4	9⅛	4	3[illegible]	1[illegible]
4½	114	22	6⅛	15¾	4½	10⅛	4½	455	1[illegible]

CHECK LINK TO LINK CL. TO SEE SHACKLE



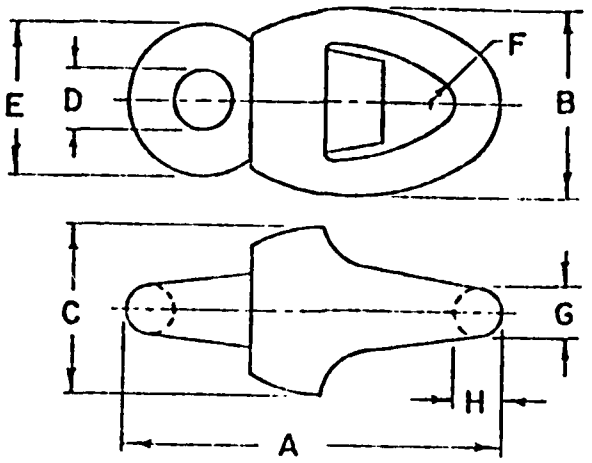
CENTERLINE DIM.

BALDT CHAIN SHACKLE SAFETY TYPE



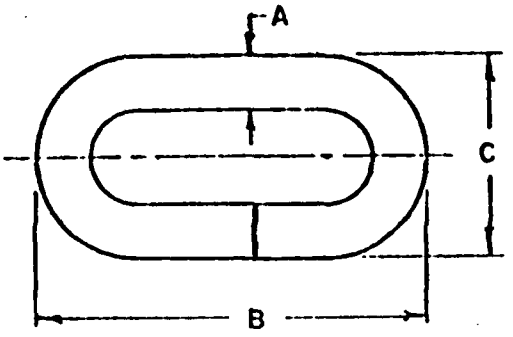
SHACKLE SIZE		A	B	C	D	E	F	WEIGHT LBS.	SAFE WORKING LOAD TONS
INCHES	MM								
1	25	3¾	1⅛	3⅛	1⅛	2⅛	1	6	2.5
1¼	32	4⅞	2⅛	4⅛	1⅞	3	1¼	11	12
1½	38	5⅛	2½	5⅛	1⅝	3⅝	1½	19	17
2	51	7⅛	3¼	7⅛	2⅝	5	2	45	35
2½	64	9⅛	4⅛	9⅛	2⅞	6	2½	81	55
3	76	10⅝	5	11	3⅛	6½	3	139	85
3½	89	12⅛	5⅝	12⅝	3⅝	8	3½	241	120
4	102	19	5⅝	13⅝	4	9⅛	4	3[illegible]	1[illegible]
4½	114	22	6⅛	15¾	4½	10⅛	4½	455	1[illegible]

BALDT SWIVELS



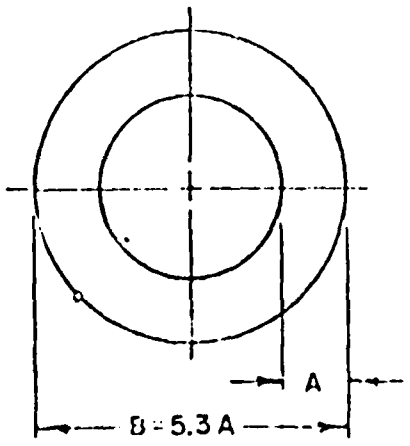
CHAIN SIZE		A	B	C	D	E	F	G	H	WEIGHT LBS.
INCHES	MM									
[illegible]-¾	17- 19	6⅞	3	2⅜	1⅛	2⅝	½	¾	¾	4
⅞- 1	21- 22	7⅝	3⅛	3¼	1¼	3	⅝	⅞	⅞	7
1⅛-1	24- 25	8⅜	4⅛	3⅛	1½	3½	⅝	1	1	11
1⅛-1⅜	27- 29	10	4⅞	4⅛	1⅝	3⅞	⅞	1⅛	1⅛	16
1⅜-1⅝	30- 35	12⅛	6	4⅞	2	4⅝	1⅛	1⅜	1⅜	27
1⅝-1⅞	36- 41	14⅛	7⅛	5⅝	2⅜	5⅜	1⅜	1⅝	1⅝	50
1⅞-1⅞	43- 48	16⅞	8⅜	6⅜	2⅞	6⅜	1⅝	1⅞	1⅞	71
1⅞-2⅛	49- 54	19⅛	10⅛	7⅜	3⅛	7⅜	1⅞	2⅛	2⅛	113
2⅛-2⅜	59- 67	22⅜	12	9	3¾	9	1¾	2⅜	2⅜	153
2⅜-2⅝	68- 73	26	12⅞	10⅛	4	10	1⅞	3	3	233
2⅝-3⅛	75- 79	28⅛	13⅛	11⅛	4⅜	10⅜	2⅛	3⅛	3⅛	299
3⅛-3⅜	81- 86	30⅛	14⅛	12	4⅝	11⅛	2⅛	3⅜	3⅜	375
3⅜-3⅝	87- 92	32⅜	15⅛	12⅛	5⅛	11⅝	2⅜	3⅝	3⅝	464
3⅝-3⅞	94- 98	34⅝	16⅛	13⅛	5⅛	12⅝	2⅜	4	4	557
3⅞-4	100-102	36⅛	17⅛	14⅛	5⅝	13⅛	2⅝	4⅛	4⅛	624

BALDT END LINKS



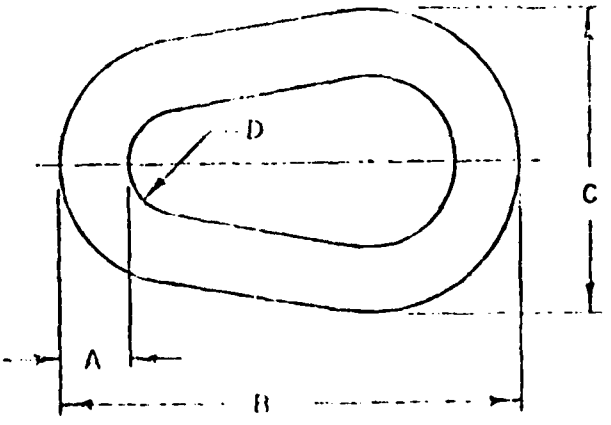
CHAIN SIZE		A	B	C	WT. LBS	PROOF TEST IN POUNDS
INCHES	MM					
5/16-3/8	17-19	1 1/16	5 5/8	2 3/8	1.8	40,000
7/16-1/2	21-25	1 3/8	7 1/2	3 1/4	4.0	84,000
9/16-11/16	27-33	1 3/4	9 1/8	4 1/8	8.0	130,000
13/16-15/16	33-38	1 7/8	11 1/4	5 1/4	14.2	185,000
1 1/16-1 3/16	40-44	1 7/8	13	6 1/8	21.6	249,000
1 1/4-2	45-51	2 1/8	15	7 1/8	34.2	322,000
2 1/16-2 1/4	52-58	2 3/4	16 5/8	8 1/8	45.4	403,000
2 5/16-2 1/2	59-64	2 7/8	18 1/2	9 1/2	62.0	492,000
2 9/16-2 3/4	65-70	3 1/8	20 1/8	10 1/2	81.0	590,000
2 13/16-3	71-76	3 1/8	22 1/2	11 1/8	103.0	695,000
3 1/16-3 1/4	78-83	3 1/2	25 1/8	12 3/4	148.0	820,000
3 5/16-3 1/2	87-95	3 7/8	28	14 1/4	202.0	1,120,000
3 9/16-4	97-102	4 3/4	30	15 1/4	258.0	1,248,000

BALDT RINGS



BALDT PEAR SHAPED RINGS

B = 8.17A
C = 4.25A
D = .75A



EC-2 Typhoon Survival Mooring

INSTALLATION SCENARIO OUTLINE

1.0 INTRODUCTION

1.1 Scope: This scenario outlines the special requirements for the fit-check and installation of the EC-2 Typhoon Survival mooring at Apra Inner Harbor. It is supplemental to standard practices and PWC Guam selected methods.

1.2 Configuration: The general configuration of the mooring was provided in reference (a) with a hardware list and a description of installation support requirements.

1.3 Ground Chain Rigging: The on-bottom layout of the ground chain array is in process of finalization by CHESDIV/FPO-1. This will specify:

a. the anchor circle radius

b. the orientation of the ground chain legs around the anchor circle,

c. the separation distances between the tandem and parallel anchors initially and after setting of the anchors and

d. the "slack" or extra links to be left in the ground chain legs after marking each at the common intersection at the central sinker location.

2.0 PREASSEMBLY AND ON-SITE MOBILIZATION

o Stage all component hardware in an area which allows the physical connection of each component. Each component should be thoroughly inspected for fit and function.

- o Work Platform - The mooring installation will require a platform suitable to handle the deck loading of anchors and chain. A crane or other means of handling anchors and chain will be required. Ancillary vessels for barge and crane movement will be required.

3.0 SURVEY

- o Survey markers (buoys with sinkers) must be placed to accurately establish anchor and chain locations. Survey markers must be located using known datum or bench marks.

4.0 ANCHOR INSTALLATION AND PULL TEST

- o Install the preassembled anchors, with attached chain, at the survey points. Installation will require lifting the anchor from a platform and placing it in proper orientation on the bottom.

- o Each anchor chain must be laid on the bottom from the anchor towards the marker buoy locating the center of the mooring.

- o A horizontal pull of 200K lbs must be applied to each mooring leg pair, or a pull test of 100K lbs per leg may be applied. The pull test may be accomplished using a moored barge with a winch, winch/beach gear or hydraulic puller. A vessel may also be used to apply force.

- o After the pull test, each chain leg will be marked (by a diver) at the center of the mooring. Each chain will be cut on the surface to provide a specified number of extra "slack" links beyond the center marked-link. The leg is then lowered to the bottom, and connected to a central ground ring.

5.0 BUOY INSTALLATION

- o All anchors should be set, all anchor chains connected and in proper location on the bottom and all riser chain attached to the ground ring prior to the final connection of the buoy. The buoy should be checked for transportation damage prior to installation.

- o The buoy is installed by placing a crane wire through the center pipe and connecting the crane wire to the riser chain. The riser chain is then pulled to the surface, up through the buoy, and the final assembly of hardware completed on the deck of the buoy.

- o Final Inspection - The mooring should be inspected by a qualified diving team to confirm the proper placement of all components and to provide "as-built" information for final documentation.

Ref (f): encl (6)

FPO-1[illegible]:hw
11000

12 MAR 1980

From: Commanding Officer, Chesapeake Division
Naval Facilities Engineering Command
To: Commander, Pacific Division
Naval Facilities Engineering Command
(Attention Code 102)

Subj: IC-7 Typhoon Survival Mooring Installation Guidelines

Ref: (a) CHESNAVFACENGCOM ltr FPO-1ED6:hw, Ser 11000 of 28 Feb 80

Encl: (1) Installation Guidelines
(2) Copy of Reference (a)

1. Enclosure (1) is the Installation Guideline for the subject mooring in APRA Inner Harbor.

2. Another copy of reference (a) is provided as enclosure (2).

3. Mr. John Ess (Code FPO-1E) and Mr. Charles Bodey (Code FPO-1L) of this Command are available (AUTOVON 285-3881) to answer any questions or to help on any hardware substitution requirements.

J. A. [illegible]
By direction

Copy to:
[illegible] Guam

FPO-1
FPO-1CF (2)
FPO-1L
FPO-1L2
FPO-1T2
FPO-1EA
Daily
Route
0161(2)

INSTALLATION GUIDELINES
FOR
EC-2 TYPHOON SURVIVAL MOORING

(CHESDIV/FPO-1, 14 March 1980)

1.0 INTRODUCTION

These guidelines outline an installation scheme which will meet the configuration and functional requirements of the EC-2 Typhoon Survival Mooring; and it can reduce the amount of underwater inspection and hook-up requiring diver support.

This Guideline supplements the following information provided by FPO-1 previously:

(a) Sinker Design Sketch, Quality Control Requirements and Installation Scenario Outline (CHESNAVFACENGCOM ltr, FPO-1ED6:bw Ser 11000 of 28 Feb 1980)

(b) Procurement and Installation Information (CHESNAVFACENGCOM ltr, FPO-1E:bw Ser 11000 of 17 Jan 1980)

(c) Firm Hardware List for Modified Class CC Mooring (CHESNAVFACENGCOM Washington DC 161615Z Jan 80)

2.0 MOORING SITE

The site of the mooring is APRA Inner Harbor approximately 500 feet west of sites 25N/25S as shown in SKC 31080. The site location may be changed somewhat as a result of the CEL Soft-Soil anchor testing at the harbor in March.

3.0 DESCRIPTION OF MOORING

The mooring consists of three equi-spaced ground legs with two 2.25 inch chains per leg as shown in SKC 3980. Each chain carries two anchors in tandem in order to develop the holding power in soft soil that is necessary to match the working strength of the 2.25 inch chain. The combined weight of each pair

of tandem anchors is 25 KIPS. Each set of chains is connected to a spider plate and each of the three ground leg spider plates connects to the ground ring at the 15 KIP central sinker as shown in SKC 31180. A 3.5 inch riser chain connects the ground ring and the peg-top buoy.

4.0 SURVEY AND MARKERS

Survey markers must be placed at the mooring site using established datum locations. Survey markers can be constructed using plastic pipe floats (20' x 2" diameter) and a sinker weight with an appropriate length of line. The site markers can be placed using transits and to establish bench marks on shore. A small boat can be used to place markers after being directed, via radio, to the proper location by the transit surveyors. Site markers should be placed to within a relative accuracy of $\pm$ 5 feet of each other; and the center of the mooring should be located per PWC requirements.

Survey markers will be required at the following locations minimum:

- o center of the mooring (1)
- o each outboard anchor location (6)
- o each leg at 342' - 8" radius from the mooring center (6)

Survey locations may also be required to locate construction platform mooring anchors, to establish range markers for pulling vessels and to locate special markers to aid assembly.

An as-built survey is recommended to document the final locations of the anchors and mooring buoy.

Sketches SKC 3980 and SKC 31080 provide a project site plan and plan view of the mooring.

5.0 ANCHOR INSTALLATION AND PULL TEST

The installation of each anchor pair and the associated anchor chain can be accomplished using the following proposed method:

5.1 Each anchor leg is assembled on to the work platform in a manner which allows the chain to run free during placement. The inboard anchor of each leg must be placed on the side of the barge in order to allow the outboard anchor to reach the bottom with 45' of chain between the anchors.

5.2 The outboard anchor is placed on bottom approximately 50' outside of the final anchor position. The 50' distance will be used to allow the anchor to set during pull tests. The inboard anchor is then placed. The proper location to place and align each anchor can be determined by survey locations. Place anchors' fluke down, with the chain between anchors straightened out, before starting to drag and bury anchors.

5.3 Each anchor leg may be pull tested individually to 100K lbs tension, or after placement of the adjoining leg, the two legs may be pull tested to 200K lbs tension.

5.4 It is important that each anchor leg be pull tested with the tension applied along the exact line of the anchor leg. The pulling barge or pulling craft must be able to maintain an accurate in-line position during the pull test. Survey markers and/or range markers may be required to assist in maintaining position. The drag line, or chain used for setting and load

testing the anchors may require weighting to enable the anchors to bury, and to avoid pull-out of the lead anchor due to up-angle on the shank.

5.6 The anchors must be set by dragging in tandem for at least 50', and until their radial distance from the center of the mooring is no less than shown on SKC 3980.

5.7 If the anchors do not meet the load-test requirement, they must be re-set in undisturbed soil. This can be done by re-orienting the entire array of ground legs by 10^{o}; or the anchors can be set at a greater radial distance along the original angular orientation by at least 60 feet and additional chain will need to be added to reach the center of the mooring and provide the 15' (nominal) excess chain length for fit-up.

6.0 MEASUREMENT OF CHAIN LEGS

In order to attain the design load capacity and load sharing capability of each anchor leg, the anchor chain must be measured and custom fitted after the anchor pull test. It is suggested that this task be accomplished by placing the anchor chain on the bottom (under tension) in a straight line between the survey marker locating the pre-established 342' -8" anchor radius location and past the center of the mooring. Measure along the chain from the center buoy survey marker, a total of 15' and mark the chain. Lift the chain to the surface and remove the excess chain extending past the mark. Each of the six chain legs must be measured and cut in a similar manner.

7.0 ASSEMBLY OF MOORING LEGS

With the completion of the pull test and the accurate measurement of each chain leg, the mooring legs are ready for final assembly. The joining of the individual legs can be completed on the surface using a floating crane. The following procedure is proposed for consideration:

7.1 Attach a lift line to each of two adjacent pairs of chains and pay out lift line as the crane barge is moved to a location midway between the anchors of the chain legs involved. This provides sufficient slack chain so that each pair of chains can be hoisted onto the deck of the barge and secured.

7.2 Attach the chains of leg "A" to one spider plate and the chains of leg "B" to another. Check to assure that the chains of each leg-pair are not entwined and that legs "A" and "B" are not twisted or entwined.

7.3 Orient the sinker on the barge and connect the two spider plates, and the sinker to the ground ring so that the sinker can be lowered to the bottom later without tangling the legs.

7.4 Rig a lift line to the two chains of leg "C" and tow and/or kedge the crane barge toward the mooring center with the sinker and attached legs "A" and "B" fast on deck. When the barge is at or near the center marker of the mooring the two chains of leg "C" can be raised to the barge deck with a lift approximately 5 tons.

7.5 The two chains of leg "C" are fitted to a spider plate as were legs "A" and "B". The "C" spider is then attached to the ground ring.

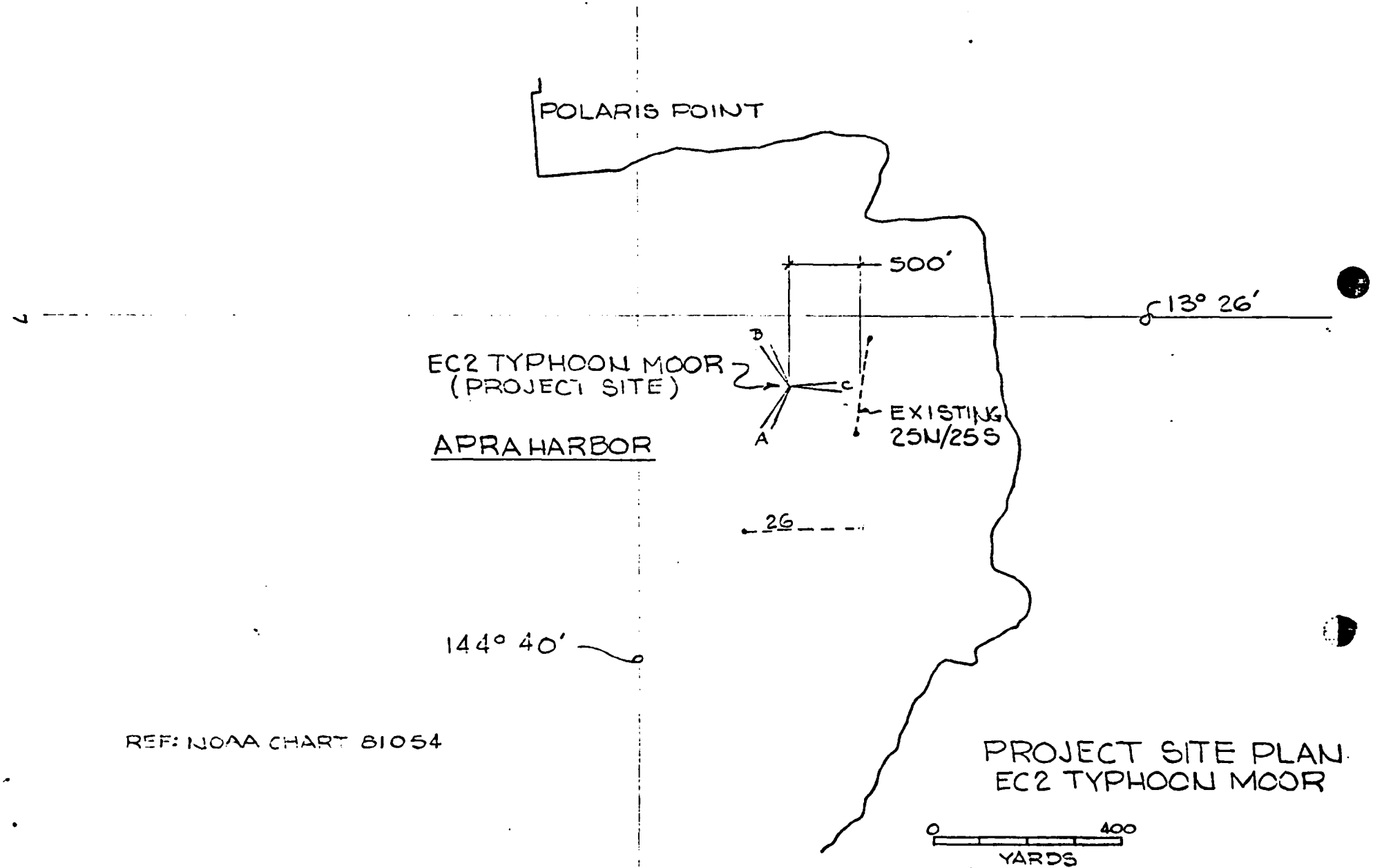
7.6 The 3½" riser chain is rigged through the buoy and is connected to the ground ring. The buoy is then over boarded with the riser chain lower end attached to the ground ring at the sinker. The ground chain array is lifted by the crane, over board, and lowered so as to place the sinker at the center of the mooring.

7.7 The mooring is then inspected to insure that the:

(a) Sinker is not on top of any of the ground chains,

(b) Riser chain and the three spiders with their pairs of ground chains are not tangled at the ground ring and are oriented properly with respect to the anchors.

7.8 The mooring installation may be functionally tested by pulling on the end ring of the buoy with a tug in 6 equally spaced directions with at least 50 KIPS bollard pull.


POLARIS POINT
500'
13° 26'
B
EC2 TYPHOON MOOR
(PROJECT SITE)
C
A
EXISTING
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APRA HARBOR
26
144° 40'
REF: NOAA CHART 81054
PROJECT SITE PLAN
EC2 TYPHOON MOOR
0
400
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ONLY
SKC 31080


LEG C
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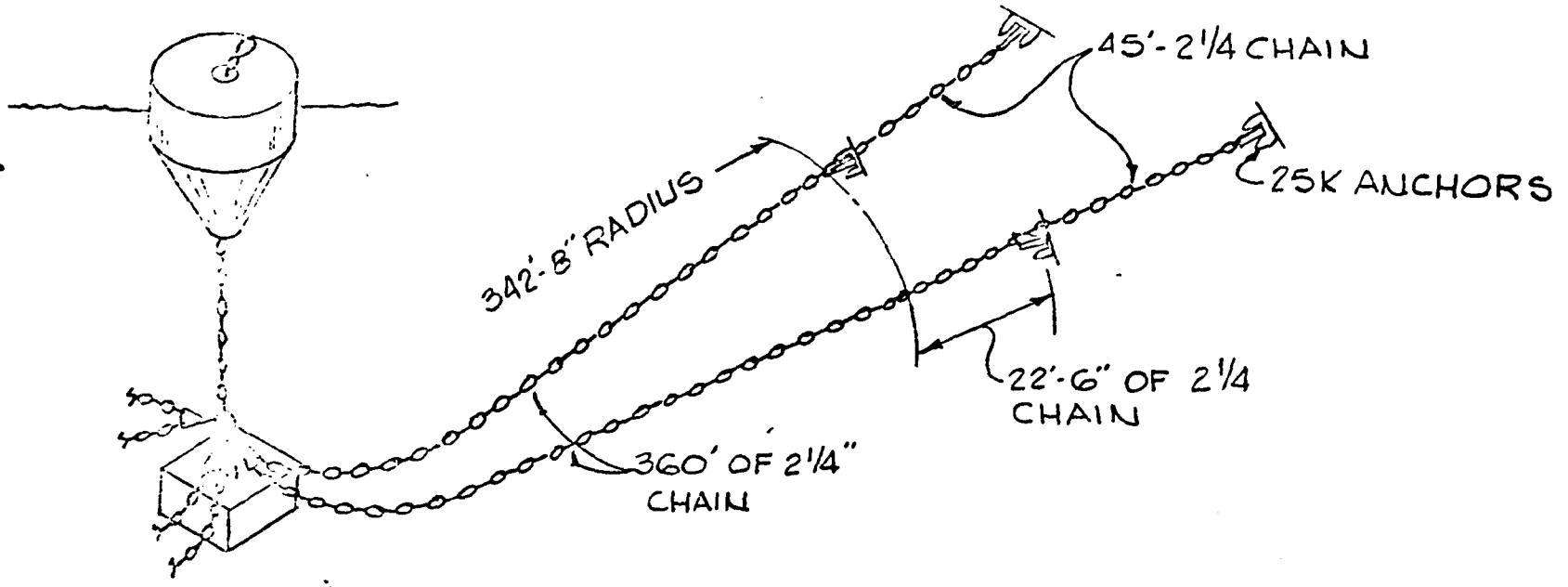
PLAN VIEW
SCALE 1" = 30'



PICTORIAL VIEW
EC2 TYPHOON MOOR

SKC 31180

Ref (g); encl (7)

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ROUTINE

2421497 OCT 80

FM COMNAVELEXSYSCOM WASHINGTON DC

TO PWC GUAM CHESNAVFACENGCOM WASHINGTON DC

INFO COMNAVFACENGCOM ALEXANDRIA VA PACNAVFACENGCOM PEARL HARBOR HI
AVSTA GUAM

UNCLAS //N11000//

SUBJ: MODIFIED CLASS CC MOORING

. PWC GUAM 120331Z SEP 80
. PWC GUAM LTR 106/ESM/SMS 11100 SER 1841 DTD 26 SEP 80
. PWC GUAM 170501Z OCT 80

. REF A INDICATES THAT 62.7K DOLLARS TRANSMITTED TO PWC GUAM COVERS
OLLOWING CLASS CC MOORING TASKS:
A. PROCUREMENT OF COMPONENTS
B. ANCHOR STABILIZER FABRICATION
C. SURVEY AND ENG SUPPORT
D. ASSEMBLY AND TRANSPORT OF COMPONENTS TO SITE
E. MOORING EMPLACEMENT
DITIONAL FUNDS OF 103.5K DOLLARS REQUESTED FOR ANCHOR SETTING AND
ULL TEST HAVE NOT BEEN IDENTIFIED AND ARE NOT IMMEDIATELY AVAILABLE.

FOR PWC GUAM: REQ PROCEED WITH CURRENTLY FUNDED TASKS OF PARA
-1E ABOVE. REQUIRED MOORING COMPLETION REMAINS DEC 1980.

FOR CHESDIV: IN VIEW OF RESTRICTED FUNDING, REQ REVIEW ANCHOR
TTING AND PULL TEST REQUIREMENTS OF MOORING DESIGN. ANALYSIS
SIRED NLT 7 NOV.

IPT REFS B AND C, FURTHER FUNDING WITHHELD PENDING COMPLETION OF
HESDIV ANALYSIS.

VR:CHESNAVFACENGCOM WASHINGTON DC(7)...ACT

PTD:000-000/COPIES 0007

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Ref (h); encl (8)

01 03 PP RR UUUU 3121200

CHESNAVFACENGCOM WASHINGTON DC

PWC GUAM

INFO PACNAVFACENGCOM PEARL HARBOR HI

UNCLAS //N11153//

SUBJ: MODIFIED CLASS CC MOORING

A. COMNAVELEXSYSCOM 2421497 OCT 80

B. PWC GUAM 2900167 OCT 80

C. FONECON BTWN MR. T. O'BOYLE (CHESDIV) AND MR. E. SAN NICOLAS (PWC GUAM) ON 5 NOV 80

1. AS REQUESTED BY REF A AND B, THE FOLLOWING ANALYSIS OF THE SETTING AND PULL TEST REQUIREMENTS OF THE MOORING DESIGN IS FORWARDED.

2. THE UNAVAILABILITY OF FUNDS TO CONDUCT THE 100,000 LB PULL TEST ON THE SIX TWO-ANCHOR LEGS PLACES INCRE SED IMPORTANCE ON CORRECT ANCHOR FLUKE EMPLACEMENT. WHERE POSSIBLE, DIVERS MUST ENSURE AND DOCUMENT WITH PHOTOGRAPHS THAT THE FLUKES ARE READY TO EMBED. ALSO OF INCREASED IMPORTANCE IS THE NEED TO HAVE ALL CHAIN PAIRS STRAIGHT, TIGTH, AND MEET AT THE SPIDER PLATE WITH NO SLACK IN THE CHAIN.

3. DURING REF C, THE INSTALLATION PROCEDURE SUMMARIZED WAS UNDERSTOOD TO BE:

THOMAS J. O'BOYLE, FPO-1ED7
433-3881

COPY TO: FPO-1...FPO-1ED...09...
FPO-1EA...FPO-1CP...FPO-1ED7...
DAILY...ROUTE...0161(2)

J. A. STAMM, CDR, CEC USN 33881

A. THE SINKER, RISER AND BUOY WOULD BE INSTALLED AT THE CENTER MARKER BUOY FIRST.

B. THE LONGER OF THE TWO CHAINS, IN EACH OF THE THREE CHAIN PAIRS, WOULD THEN BE INSTALLED ANCHOR LAST. THIS WOULD BE DONE BY LETTING OUT CHAIN UNDER TENSION AS THE BARGE MOVES OUTWARD TOWARD THE ANCHOR INSTALLATION MARKER BUOY. THE INBOARD ANCHOR WOULD BE LOWERED USING THE CRANE. THE TUG WOULD APPLY A PULL TO THE BARGE/CHAIN TO STRAIGHTEN AND TIGHTEN THE CHAIN. THE OUTBOARD ANCHOR WOULD THEN BE LOWERED WITH THE WINCH.

C. AFTER ALL THREE LONGER CHAINS ARE IMPLANTED, THE THREE SHORTER CHAINS WOULD BE IMPLANTED USING THE SAME PROCEDURE.

D. AFTER ALL SIX CHAINS ARE IMPLANTED, THE ANCHORS WOULD BE LEFT ALONE FOR 24 HOURS.

E. THE 100 TON CRANE BARGE WOULD THEN BE BROUGHT TO THE CENTER AND PICK UP THE BUOY/RISER/SINKER. THIS WOULD CREATE A HORIZONTAL FORCE AT THE ANCHORS THAT WOULD START TO EMBED THEM.

4. THIS PROCEDURE SHALL BE FOLLOWED, WITH THESE ADDITIONS, TO SATISFY THE MINIMUM INSTALLATION QUALITY ASSURANCE REQUIREMENTS:

JOINT MESSAGE FORM

03 03 PP RR UUUU 3121200

A. EMPHASIS SHALL BE PLACED ON ANCHOR FLUKE ORIENTATION AND ASSURANCE THE CHAIN IS STRAIGHT AND TIGHT FROM THE GROUND RING TO THE OUTBOARD ANCHOR PRIOR TO LIFTING THE GROUND RING.

B. AFTER STEP 3.D ABOVE, DIVERS SHALL ENSURE AND DOCUMENT WITH PHOTOGRAPHS, WHERE POSSIBLE, THE ANCHOR FLUKE ORIENTATION IS PROPER.

C. AFTER STEP 3.E ABOVE, DIVERS WILL ENSURE AND DOCUMENT WITH PHOTOGRAPHS, WHERE POSSIBLE, ANY EMBEDMENT OF THE ANCHORS, AND THAT NONE OF THE ANCHORS PULLED OUT OR TURNED OVER.

5. IT IS REQUESTED PWC GUAM FORWARD ANY ESTIMATED COST INCREASE OVER THE $62.7K ALREADY FUNDED TO DO THE INSTALLATION BY THIS PROCEDURE.

END

DTIC

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